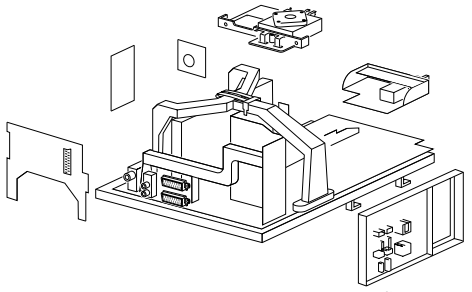
EM3E
AA

Service
Service
Service



Service Manual

Contents			Page	
1	Technical Specifications, Connection Facilities and Chassis Overview		2	
2	Safety Instructions, Maintenance, Warnings and Notes		4	
3	Directions for Use		6	
4	Mechanical Instructions		20	
5	Service Modes, Error Codes, Faultfinding and Repair Tips.		23	
6	*Block Diagrams*			
	Block Diagram (Supply, Deflection)		35	
	Block Diagram (SSB Video)		36	
	Block Diagram (SSB Audio)		37	
	Supply Lines Overview		38	
	Wiring Diagram		39	
	I^2C Overview		40	
	Testpoint Overviews		41	
7	*Electrical Diagrams and PWB lay-outs*		*Diagram*	*PWB*
	Main Supply	(Diagram A1)	42	51-56
	Stand-by Supply	(Diagram A2)	43	51-56
	Line Deflection	(Diagram A3)	44	51-56
	Frame Deflection E/W Drive	(Diagram A4)	45	51-56
	Rotation Circuitry	(Diagram A5)	46	51-56
	Audio Amplifier	(Diagram A6)	47	51-56
	Headphone Amplifier	(Diagram A7)	46	51-56
	Tuner, I/O, SIMM (Female)	(Diagram A8)	48	51-56
	Front	(Diagram A10)	49	51-56
	Inputs / Outputs	(Diagram A11)	50	51-56
	SIMM (Male)	(Diagram B1)	57	64-73
	IF, I/O, Video Processing	(Diagram B2)	58	64-73
	Featurebox (PICNIC)	(Diagram B3)	59	64-73
	Video Control (HOP)	(Diagram B4)	60	64-73
	Teletext & Control (OTC)	(Diagram B5)	61	64-73
	Audio Demodulator	(Diagram B6)	62	64-73
	Falconic	(Diagram B8)	62	64-73

Contents			Page	
	Mains Switch Panel	(Diagram E)	74	74-75
	CRT Panel	(Diagram F)	76	77
	DC-Shift Panel	(Diagram G)	78	78
	I/O 3rd SCART Panel	(Diagram H)	80	81
	VDAF + 2nd Order S Panel	(Diagram I)	82	83
	Side I/O Panel	(Diagram O)	84	85
	Top Control	(Diagram P)	86	86
8	Electrical Alignments		87	
9	Circuit Descriptions		94	
	List of Abbreviations		109	
10	Spare Parts List		111	

©Copyright 2001 Philips Consumer Electronics B.V. Eindhoven, The Netherlands.
All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying, or otherwise without the prior permission of Philips.

Published by CO 0066 Service PaCE Printed in the Netherlands Subject to modification GB 3122 785 11360

PHILIPS

1. Technical Specifications, Connection Facilities and Chassis Overview

1.1 Technical Specifications

1.1.1 Reception

Tuning system	:	PLL
Colour systems	:	PAL B/G, D/K, I
	:	SECAM B/G, D/K, L/L'
	:	NTSC 4.43 (playback only)
Sound systems	:	FM-mono B/G
	:	FM-mono D/K
	:	FM-mono I
	:	AM-mono L/L'
	:	2CS B/G
	:	2CS/Chez D/K
	:	NICAM B/G
	:	NICAM D/K
	:	NICAM I
	:	NICAM L
A/V connections	:	PAL B/G, D/K, I
	:	SECAM B/G, D/K, L/L'
	:	NTSC 4.43 (playback only)
Channel selections	:	100 channels
	:	VHF, UHF, S-Channels and Hyperband
Aerial input	:	75 Ω, Coax
VCR preselections	:	0 and 90 - 99

1.1.2 Miscellaneous

Mains voltage	:	220 - 240 V (± 10 %)
Mains frequency	:	50 / 60 Hz (± 5 %)
Ambient temperature	:	+ 5 to + 45 deg. C
Maximum humidity	:	90 % R.H.
Standby Power consumption	:	1 W

1.2 Connection Facilities

1.2.1 Front Controls / Side Connections

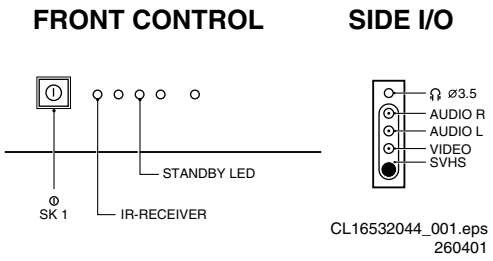


Figure 1-1

Audio / Video In

- - Video	CVBS (1 Vpp / 75 Ω)	
- - Audio	L (0.5 Vrms / 10 kΩ)	
- - Audio	R (0.5 Vrms / 10 kΩ)	
- - Headphone	(32 - 2000 Ω / 10 mW)	

SVHS (in)

1 -	GND	
2 -	GND	
3 - Y	(1 Vpp / 75 Ω)	
4 - C / 16:9	(0.3 Vpp / 75 Ω)	
5 -	GND	

1.2.2 Rear Connections

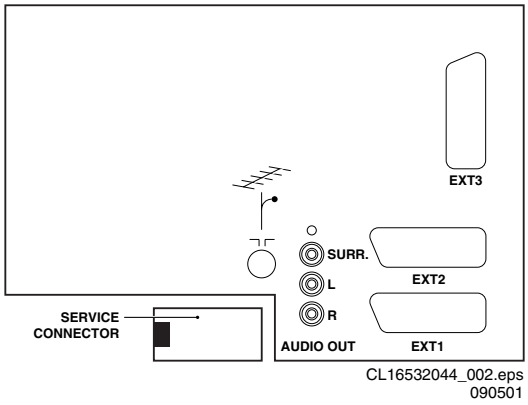


Figure 1-2

Audio Out

- - Audio	Surr. (0.5 Vrms / 1 kΩ)	
- - Audio	L (0.5 Vrms / 1 kΩ)	
- - Audio	R (0.5 Vrms / 1 kΩ)	

External 1 (in/out): RGB/YUV + CVBS

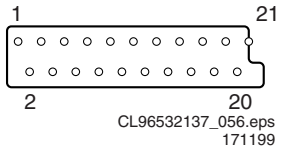
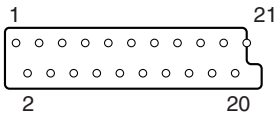


Figure 1-3

1 - Audio	R (0.5 Vrms / 1 kΩ)	
2 - Audio	R (0.5 Vrms / 10 kΩ)	
3 - Audio	L (0.5 Vrms / 1 kΩ)	
4 -	GND	
5 -	GND	
6 - Audio	L (0.5 Vrms / 10 kΩ)	
7 - Blue / U	(0.7 Vpp / 75 Ω)	
8 - CVBS-status	0 - 1.3 V: INT 4.5 - 7 V: EXT 16:9 9.5 - 12 V: EXT 4:3	
9 -	GND	
10-		
11- Green / Y	(0.7 Vpp / 75 Ω)	
12-		
13-	GND	
14-	GND	
15- Red / V	(0.7 Vpp / 75 Ω)	
16- RGB-status	0 - 0.4 V: INT 1 - 3 V: EXT / 75 Ω	
17-	GND	
18-	GND	
19- CVBS	(1 Vpp / 75 Ω)	
20- CVBS	(1 Vpp / 75 Ω)	
21- Earth	GND	

External 2 (in/out): SVHS + CVBS (intended for VCR)

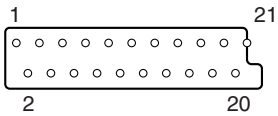


CL96532137_056.eps
171199

Figure 1-4

1 - Audio	R (0.5 Vrms / 1 kΩ)	⊖→
2 - Audio	R (0.5 Vrms / 10 kΩ)	⊖→
3 - Audio	L (0.5 Vrms / 1 kΩ)	⊖→
4 -	GND	⏚
5 -	GND	⏚
6 - Audio	L (0.5 Vrms / 10 kΩ)	⊖→
7 - C	(0.7 Vpp / 75 Ω)	⊖→
8 - CVBS-status	0 - 1.3 V: INT 4.5 - 7 V: EXT 16:9 9.5 - 12 V: EXT 4:3	
9 -	GND	⏚
10-	Easy link (P50)	
11-		
12-		
13-	GND	⏚
14-	GND	⏚
15- C	(0.7 Vpp / 75 Ω)	⊖→
16-		
17-	GND	⏚
18-	GND	⏚
19- CVBS	(1 Vpp / 75 Ω)	⊖→
20- Y / CVBS	(1 Vpp / 75 Ω)	⊖→
21-	GND	⏚

External 3 (in): CVBS

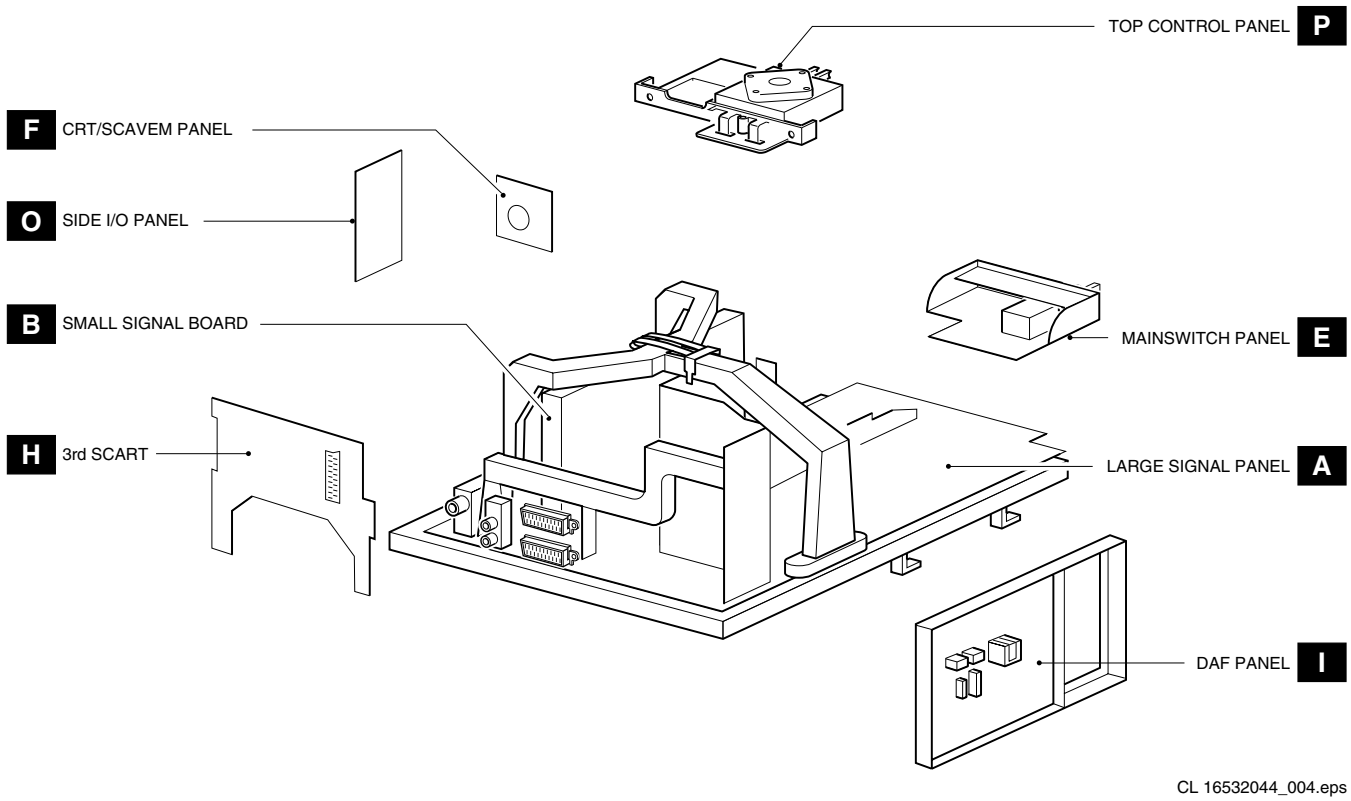


CL96532137_056.eps
171199

Figure 1-5

1 -		
2 - Audio	R (0.5 Vrms / 10 kΩ)	⊖→
3 -		
4 -	GND	⏚
5 -	GND	⏚
6 - Audio	L (0.5 Vrms / 10 kΩ)	⊖→
7 -		
8 - CVBS-status	0 - 1.3 V: INT 4.5 - 7 V: EXT 16:9 9.5 - 12 V: EXT 4:3	
9 -	GND	⏚
10-		
11-		
12-		
13-	GND	⏚
14-	GND	⏚
15-		
16-		
17-	GND	⏚
18-	GND	⏚
19-		
20- CVBS	(1 Vpp / 75 Ω)	⊖→
21-		

1.3 Chassis Overview



CL 16532044_004.eps
140501

Figure 1-6

2. Safety & Maintenance instructions, Warnings and Notes

2.1 Safety instructions for repairs

Safety regulations require that during a repair:
- Due to the chassis concept, a very large part of this chassis (incl. deflection) is 'hot'. Therefore the set must be connected to the mains via an isolating transformer.
- Safety components, indicated by the symbol ⚠, should be replaced by components identical to the original ones.
- When replacing the CRT, safety goggles must be worn.

Safety regulations require that after a repair, the set must be returned in its original condition. In particular attention should be paid to the following points:
- General repair instruction: as a strict precaution, we advise you to resolder the solder joints, through which the horizontal deflection current is flowing, in particular:
  - All pins of the line output transformer (LOT);
  - Fly-back capacitor(s);
  - S-correction capacitor(s);
  - Line output transistor;
  - Pins of the connector with wires to the deflection coil;
  - Other components through which the deflection current flows.

Note: This resoldering is advised to prevent bad connections due to metal fatigue in solder joints and is therefore only necessary for television sets older than 2 years.
- The wire trees and EHT cable should be routed correctly and fixed with the mounted cable clamps.
- The insulation of the mains lead should be checked for external damage.
- The mains lead strain relief should be checked for its function in order to avoid touching the CRT, hot components or heat sinks.
- The electrical DC resistance between the mains plug and the secondary side should be checked (only for sets which have a mains isolated power supply). This check can be done as follows:
  - Unplug the mains cord and connect a wire between the two pins of the mains plug;
  - Set the mains switch to the 'ON' position (keep the mains cord unplugged!);
  - Measure the resistance value between the pins of the mains plug and the metal shielding of the tuner or the aerial connection on the set. The reading should be between 4.5 MΩ and 12 MΩ.
  - Switch off the TV and remove the wire between the two pins of the mains plug.
- The cabinet should be checked for defects to avoid touching of any inner parts by the customer.

2.2 Maintenance instructions

It is recommended to have a maintenance inspection carried out by a qualified service employee. The interval depends on the usage conditions:
- When the set is used under normal circumstances, for example in a living room, the recommended interval is 3 to 5 years.
- When the set is used in circumstances with higher dust, grease or moisture levels, for example in a kitchen, the recommended interval is 1 year.
- The maintenance inspection contains the following actions:
  - Execute the above-mentioned 'general repair instruction'.
  - Clean the power supply and deflection circuitry on the chassis.
  - Clean the picture tube panel and the neck of the picture tube.

2.3 Warnings

- In order to prevent damage to IC's and transistors, all high-voltage flashovers must be avoided. In order to prevent damage to the picture tube, the method shown in Fig. 2-1 should be used to discharge the picture tube. Use a high-voltage probe and a multimeter (position VDC). Discharge until the meter reading is 0 V (after approx. 30 s).

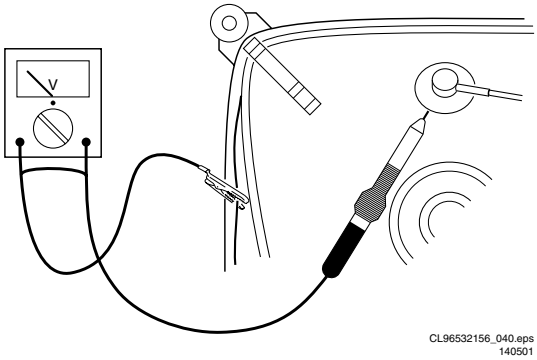


Figure 2-1

- ⚠ All IC's and many other semiconductors are susceptible to electrostatic discharges (ESD). Careless handling during repair can reduce life drastically. When repairing, make sure that you are connected with the same potential as the mass of the set by a wristband with resistance. Keep components and tools also at this same potential.
- Together with the deflection unit and any multipole unit, the used flat square picture tubes form an integrated unit. The deflection and the multipole units are set optimally at the factory. Adjustment of this unit during repair is therefore not recommended.
- Be careful during measurements in the high-voltage section and on the picture tube.
- Never replace modules or other components while the unit is switched ON.
- When making settings, use plastic rather than metal tools. This will prevent any short circuits and the danger of a circuit becoming unstable.
- Wear safety goggles during replacement of the picture tube.

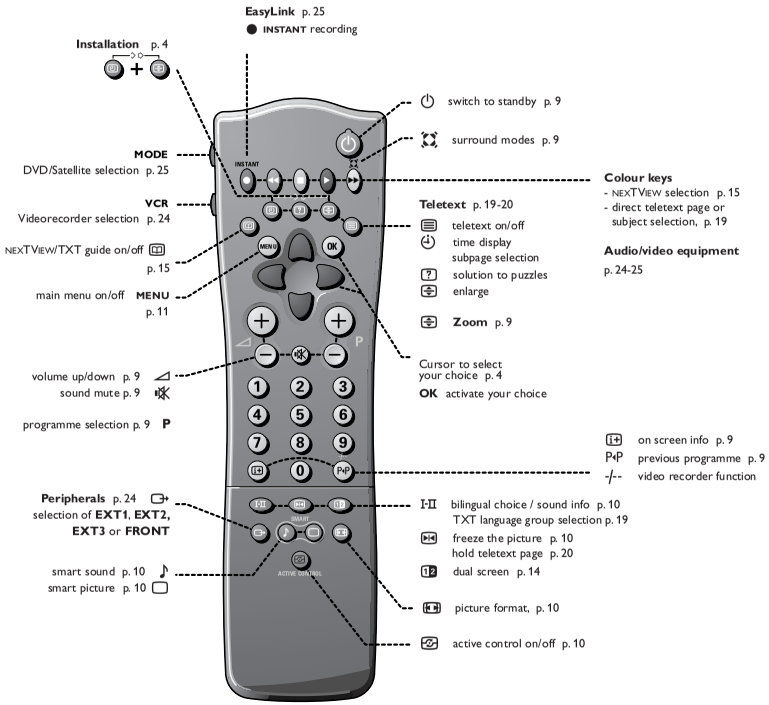
2.4 Notes

- The direct voltages and oscillograms should be measured with regard to the tuner earth (⏚) or hot earth (⏚).
- The direct voltages and oscillograms shown in the diagrams are indicative and should be measured in the Service Default Mode (see chapter 5) with a colour bar signal and stereo sound (L: 3 kHz, R: 1 kHz unless stated otherwise) and picture carrier at 475.25 MHz.
- Where necessary, the oscillograms and direct voltages are measured with (⊓) and without (⊼) aerial signal. Voltages in the power supply section are measured both for normal operation (⏻) and in Standby (⏻). These values are indicated by means of the appropriate symbols.
- The picture tube PWB has printed spark gaps. Each spark gap is connected between an electrode of the picture tube and the Aquadag coating.
- The semiconductors indicated in the circuit diagram and in the parts lists are completely interchangeable per position with the semiconductors in the unit, irrespective of the type indication on these semiconductors.
- Manufactured under license from Dolby Laboratories Licensing Corporation. DOLBY, the double D symbol and PRO LOGIC are trademarks of Dolby Laboratories Licensing Corporation.

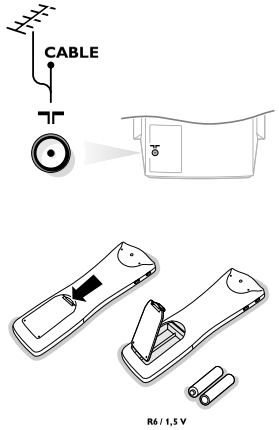
DOLBY SURROUND
PRO • LOGIC

Preparation

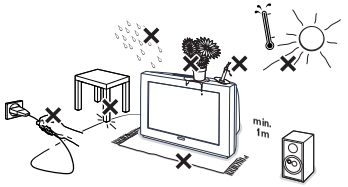
Your remote control


EasyLink p. 25
INSTANT recording
Installation p. 4
switch to standby p. 9
surround modes p. 9
MODE
DVD/Satellite selection p. 25
VCR
Videorecorder selection p. 24
NEXTVIEW/TXT guide on/off p. 15
main menu on/off MENU p. 11
Colour keys
- NEXTVIEW selection p. 15
- direct teletext page or subject selection, p. 19
Teletext p. 19-20
teletext on/off
time display
subpage selection
solution to puzzles
enlarge
Zoom p. 9
Audio/video equipment
p. 24-25
volume up/down p. 9
sound mute p. 9
programme selection p. 9 P
Cursor to select your choice p. 4
OK activate your choice
on screen info p. 9
P↔P previous programme p. 9
-/-- video recorder function
Peripherals p. 24
selection of EXT1, EXT2, EXT3 or FRONT
I-II bilingual choice / sound info p. 10
TXT language group selection p. 19
freeze the picture p. 10
hold teletext page p. 20
smart sound p. 10
smart picture p. 10
dual screen p. 14
picture format, p. 10
active control on/off p. 10

Preparation



1 **Place the TV on a solid surface.**



For ventilation, leave at least 5 cm free all around the TV.
Do not place the TV on a carpet.
To prevent any unsafe situations, do not place any objects on top of the TV.
Avoid heat, direct sunlight and exposure to rain or water.

2 **Insert the aerial plug** firmly into the aerial socket at the back of the TV.

3 Insert the mains plug in the wall socket having a mains voltage of 220V-240V.
To prevent damaging the mains (AC) cord which could cause a fire or electric shock, do not place the TV on the cord.

4 Remote control: Remove the cover of the battery compartment.
Insert the 2 batteries supplied (Type R6-1.5V).

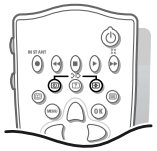
The batteries supplied do not contain the heavy metals mercury and cadmium. Nevertheless in many countries exhausted batteries may not be disposed of with your household waste. Please check on how to dispose of exhausted batteries according to local regulations.

Note: this remote control functions with TVs which use the RC6 signalling standard.

5 **Switch the TV on :** Press the power switch on the front of your TV.
A green indicator on the front of the TV lights up and the screen comes on.
If the TV is in standby mode (see p. 9), press the **- P +** key on the remote control.
The red lamp blinks every time you press a key on the remote control.
*When you switch on your set **for the first time**, the menu **LANGUAGE** automatically appears on the screen.The explanation appears in different languages one at a time. Choose your own language and press the **OK** key on the remote control.*

Go on to page 4, Store TV channels.

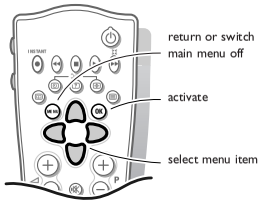
Installation



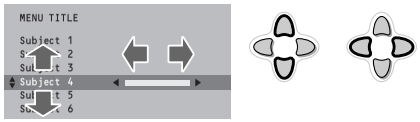
Select the INSTALLATION menu

Press ⏻ and ⇳ at the same time.

To use the menus



1. Use the cursor in the up/down, left/right directions to select a menu item.
2. Press the **OK** key to activate.
3. Use the **MENU** key to return or to switch the menu off.



Store TV channels

easy LINK

*After the new or extra TV channels have been stored, the TV automatically transfers those TV channels to the video recorder if it is equipped with the EasyLink function. The message **EasyLink : downloading .....** appears on the screen. The programme list of the video recorder is now the same as the one of the TV.*
If the TV is connected to a video recorder which supports the NEXTVIEWLink function, the TV also automatically transfers the language and country selections to the video recorder.

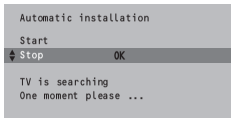
Select the menu language and country

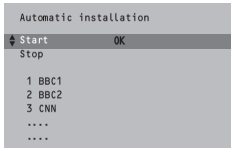
First, select your language and country.

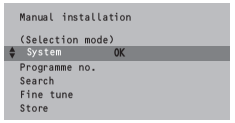
1. Select **Menu language** and press the **OK** key.
2. Select your language and press the **OK** key.
   Use the cursor up/down to scroll through the list and to bring up other languages which are not displayed on the screen at present.
3. Select **Country** and press the **OK** key.
4. Select the country where you are now located and press the **OK** key.
   Use the cursor up/down to scroll through the list and bring up other countries which are not displayed on the screen at present.

   Select **Other** when none of the countries applies.

   You can now search for and store the TV channels in two different ways: using **automatic installation** or **manual installation** (tuning-in channel by channel).
   Select your choice and press the **OK** key.







Automatic installation

In the Automatic installation menu select **Start** and press the **OK** key to activate the searching. All TV channels are searched for and stored automatically.

If a cable system which broadcasts ACI (Automatic Channel Installation) or a TV channel transmitting a teletext page with the frequencies and programme names of all the TV channels which can be received, is detected, the search is stopped and a programme list appears.
The programme list is automatically filled with all the programme numbers and names of the TV channels transmitted.

*It is possible that the cable company or the TV channel displays a broadcast selection menu. Layout and items are defined by the cable company or the TV channel. Make your choice with the cursor and press the **OK** key.*

To exit from the menu press the **MENU** key on the remote control.

Go on to page 6.

Manual installation

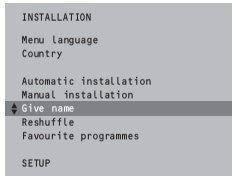
Searching for and storing TV channels is done channel by channel.
You must go through every step of the Manual installation menu.

Selection mode is only present and lights up if the country selected also offers the channel option (C-channels for aerial channels, S-channels for cable channels).
You can choose either channel or frequency mode.

1. Select the TV system
   Select the country or part of the world from where you want to receive the TV channel.
   If you are connected to a cable system, select your country or part of the world where you are now located.
2. Press the cursor down and enter the programme number with the digit keys.
3. Search for a TV channel
   Press the cursor left/right.
   The frequency or the channel number increases until a TV channel is found.

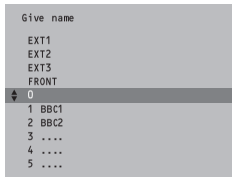
   Direct selection of a TV channel
   If you know the frequency, the C- or S-channel number, enter it directly with the digit keys 0 to 9.
   Ask for a list from your cable company or dealer, alternatively consult the Table of frequencies on the inside backcover of this handbook.
4. Fine tune
   In case of poor reception, you can improve the reception by adjusting the frequency with the cursor left/right.
5. To store your TV channel, select **Store** and press the **OK** key.

   Repeat steps 1 to 5 to store another TV channel.
6. To exit from the menu press the **MENU** key on the remote control.



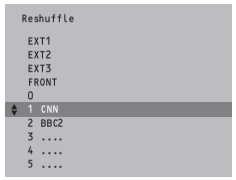
Give name

It is possible to change the name stored in the memory or to assign a name to a TV channel which has not yet been entered. A name with up to 5 letters or numbers can be given to the programme numbers 0 to 99. For example SUPER, BBC1,... Between 99 and 0 you can also name any peripherals that are connected to a euroconnector.



1. Select **Give name** in the **INSTALLATION** menu and press the **OK** key.
2. Select the programme number.
3. Press the **OK** key.
4. Select the character with the cursor up/down.
5. Select the following position with the cursor right.
6. Select the following character.
7. Press the **OK** key when finished.
8. Press the **MENU** key to return to the **INSTALLATION** menu.

Space, numbers and other special characters are located between Z and A.



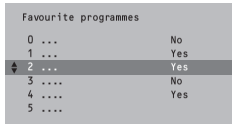
Reshuffle the programme list

According to your preference you **can** change the order of the stored TV channels.

1. Select **Reshuffle** in the **INSTALLATION** menu and press the **OK** key.
2. Select the programme number you want to exchange.
3. Press the **OK** key.
4. Select the new number you want to exchange it with.
5. Press the **OK** key.
   Repeat the operation until all TV channels are allocated as you like.
6. Press the **MENU** key to return to the **INSTALLATION** menu.

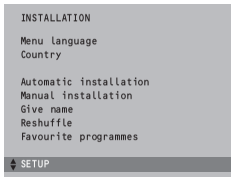
Select Favourite TV channels

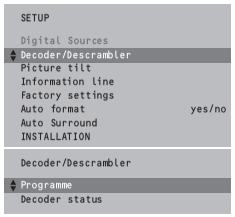
After leaving the installation you can browse through the TV channels by pressing the **- P +** key. Only those TV channels which are in the favourite list will be displayed. Non-favourite TV channels can still be selected with the digit keys. By default all stored channels are added to the favourite list.



1. Select **Favourite programmes** in the **INSTALLATION** menu and press the **OK** key.
2. Select your favourite programme number.
3. Select **Yes** or **No** with the cursor left/right.
4. Repeat for every TV channel you want to make a favourite or a non-favourite TV channel.
5. Press the **MENU** key to return to the **INSTALLATION** menu.

In order for NEXTVIEW to function properly, the first TV channel from the favourite list should also broadcast the correct local date and time via teletext.





Install TV Setup

The Setup menu allows you to adjust initial settings, i.e. those which are not related to the installation of the TV channels.
The Setup menu contains items that control the settings of the TV's functions, features, services and peripherals you may have connected.

1. Use the cursor in the up/down, left/right directions to select the menu item.
2. Use the **OK** key to activate.
3. Use the **MENU** key to return or switch menu off.

Digital sources *(for future use)*

Define Decoder/Descrambler programme numbers
If a decoder or a descrambler is connected, see p. 22 you can define one or more programme numbers as decoder programme numbers.

Press the cursor left/right to select the input used to connect to your decoder **Off**, **EXT1** or **EXT2**.
Select **Off** if you do not want the selected programme number being activated as a decoder programme number.

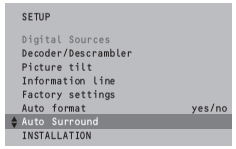
Select **EXT2** *when the decoder is connected to your EasyLink video recorder. When selecting the decoder, the message* ***EasyLink: downloading presets....*** *appears on the screen.*

Picture tilt
Select **Picture tilt** with the cursor up/down.
Keep the cursor left/right pressed to adjust the rotation of the picture.

Information line
Select **On** and after the selection of a TV programme or after pressing the i+ key on the remote control, a TV channel which broadcasts teletext may transmit the name of the TV channel, the programme name or another message. This is displayed on screen next to information about sound and picture format.
When selected **Off**, only sound and picture format information is displayed after the selection of a TV channel or after pressing the i+ key.

Factory settings
Select **Factory settings** and press the **OK** key to restore picture and sound settings, predefined in the factory.

Auto format
Selecting **Yes** causes the screen to automatically fill as much of the picture as possible when TV programmes are not carrying special signals detecting the correct screen format.
With the ⛶ key on the remote control you can still select other picture formats. See p. 10.



Auto Surround
Sometimes the broadcaster transmits special signals for Surround Sound encoded programmes. In that case, the TV automatically switches to the best Surround Sound mode when Auto Surround is switched on. Virtual Dolby* Surround will be reproduced, see p. 9.
Overruling this surround mode remains possible.

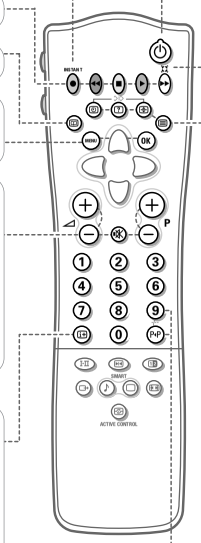
Installation
Select **Installation** and press the **OK** key to return immediately to the **INSTALLATION** menu.

4 To exit from the menu press the **MENU** key repeatedly.

'Dolby' 'Pro Logic' and the double-D symbol are trademarks of Dolby Laboratories Licensing Corporation. Manufactured under license from Dolby Laboratories Licensing Corporation.

Operation

Use of the remote control



● Instant record
If your video recorder has the EasyLink function the **INSTANT** ● key for record can be operated in the TV mode.

● ◀◀ ■ ▶ ▶▶ Video recorder see p. 24

NEXTVIEW/TXT guide on/off see p. 15

MENU Main menu on/off see p. 11

OK Press this key to activate your choice, when in the menus.

Volume
Press + or - to adjust the volume.

Mute
Temporarily interrupt the sound or restore it.

P Programme selection
To browse through the TV channels activated in the Favourite Programme menu.

Screen information
Press for 5 seconds to activate/de-activate the extended or reduced display of TV channel and programme information on the screen.
Press briefly to display information about the selected TV channel and programme, the sound reception, picture settings and the remaining time set with the sleeptimer.

0/9 Digit keys
To select a TV channel.
For a two digit programme number, enter the second digit within 2 seconds.
To switch immediately to a selected one digit TV channel, keep the digit key pressed a bit longer.

P↤P Previous programme
The previously selected TV channel is displayed.
The -/-- indication is only video recorder.

Standby
The set is switched off. To switch the TV on again, press **- P +** or the digit keys.
If your EasyLink video recorder has the system standby function and you press the standby key for 3 seconds, both the TV and video recorder are switched to standby.
Your TV consumes energy in the standby mode. Energy consumption contributes to air and water pollution. We advise to switch off your TV overnight instead of leaving it on standby. You save energy.

Surround modes

Incredible Surround
With stereo transmission, and when **Incredible Surround** is selected, it seems as though the loudspeakers are spread further apart from one another.

Virtual Dolby Surround
(optimal with Dolby Surround signals)
Virtual Dolby Surround enables you to experience the effect of Dolby Surround Pro Logic, reproducing a rear sound effect.
See Sound menu, Virtual Dolby effect, p. 12.

Teletext on/off see p. 19

Teletext functions see p. 20

Zoom
Press the **ZOOM** key repeatedly to select one of the zoom magnifications (x1, x4, x9, x16). Additionally you can shift the selected zoom window over the screen with the cursor.
Press to activate/de-activate the continuous display of the zoom magnification.
The zoom window is reset after: selecting another TV channel, another picture format or when another picture format is selected automatically.
Zooming is disabled in Dual screen mode.

Time display
The time, downloaded from the TV channel (with teletext) stored on programme number 1 or the lowest favourite programme number, is displayed on the screen.
This function is not available when continuous subtitles have been switched on.

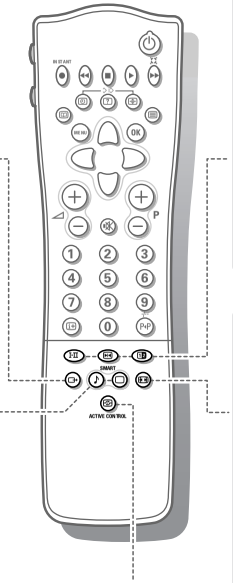
Select peripherals
Press this key repeatedly to select **EXT1**, **EXT2**, **EXT3** or **FRONT**, according to where you connected the peripherals (p. 24).

Smart Keys
To select predefined picture and sound settings.

Smart Sound
Each time it is pressed, a different sound setting is selected, corresponding with specific factory settings of the equalizer.

Smart Picture
Each time it is pressed, a different picture setting is selected, corresponding with specific factory settings of Contrast, Colour, Sharpness and Dynamic Contrast.

Personal refers to the personal preference settings of picture and sound selected in the picture and sound menu.
Remark: the moment you are in a predefined smart sound or picture setting and you modify a setting in the picture or sound menu, all values of the menu will overwrite the previously made settings.



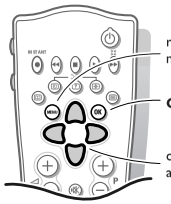
Bilingual choice and sound mode selection
Press this key
- to switch from **Stereo** to **Mono** sound, in case of stereo transmission, or from **Nicam Stereo** to **Nicam available**, in case of digital transmission;
- to choose between language I (Dual I) or language II (Dual II), in case of bilingual transmission. The setting is separately stored for each TV channel.

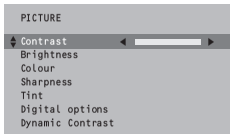
Freeze
To activate/de-activate the frozen picture or to hold a teletext page.

Dual screen, see p. 14

Picture format
Press this key repeatedly to select another picture format: 4:3, Movie Expand 14:9, Movie Expand 16:9 with or without subtitling, Wide Screen, Super Zoom or Automatic (when Auto format is set to Yes in the **SETUP** menu).
Automatic makes the picture to fill the screen as much as possible.
Sometimes also video recorder programmes carry special signals which will automatically switch the TV to the correct screen format.
Auto format is disabled when in Dual screen.
When in Movie Expand 14:9 or 16:9 or Super Zoom picture format you can make subtitles visible with the cursor up/down.

Active control
Active control is a pro-active and automatic system. The TV continuously measures and corrects all incoming signals in order to provide the best picture possible.
Press the key to select the Active Control values Off or On.
Off Sharpness and Dynamic Contrast are controlled automatically
On Sharpness, Dynamic Contrast and Noise Reduction are controlled automatically.
Press the cursor in the up/down directions while the selected Active Control setting information is on top of the screen.
The Active Control menu appears.
The picture settings are being adapted continuously and automatically.
The menu items cannot be selected.
Press the cursor in the up/down directions again to switch off the menu.





Use of the menus

1. Press the **MENU** key to display/cancel the **MAIN MENU**.
2. Use the cursor in the up/down directions to select the **PICTURE**, **SOUND** or **FEATURES** menu or to select the **PROGRAMMES**.
3. Press the cursor right to activate the selected menu.
4. Use the cursor in the up/down, left/right directions to select the menu item.
5. Use the **OK** key to activate.
6. Press the **MENU** key repeatedly to return or to switch the menu off.

Picture menu

If an NTSC peripheral is connected to one of the euroconnectors, the option Hue also appears.

Tint
Select the colour temperature: **Normal**, **Warm** or **Cool**.

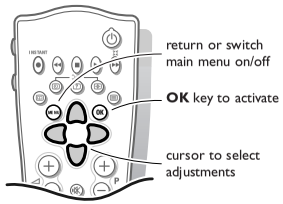
Digital options
Although Natural Motion is the most ideal setting, it may be preferable to switch back to Digital Scan and/or 100 Hz.
To make all the 3 digital options available at the same time and selectable, first select a 4:3 picture format.

- **100 Hz** = 100 Hz only (Field flicker reduction)
- **Dig. Scan** = 100 Hz + Dig. Scan (Field and line flicker reduction)
- **Natural Motion** = 100 Hz + Dig. Scan + Natural Motion (Field and line flicker reduction and smooth movement reproduction)
- **Double lines** = provides for a doubling of vertical resolution which adds astonishing sharpness and a total absence of visible picture lines. Motion compensation reduces jitter and offers smooth, yet sharp motion reproduction.

Note: if the menu item Digital options is not present, first select a 4:3 picture format with the key.

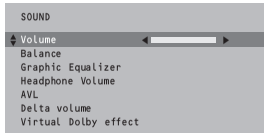
Dynamic Contrast
To make the contrast in the darker and the brighter picture areas more noticeable, select the **Med** setting.
In certain circumstances it may be preferred to select **Min, Max** or **Off**.

The modified adjustments for Contrast, Brightness, Colour, Sharpness, Tint, Digital Scan and Dynamic Contrast are automatically stored for all TV channels.
Select **Factory settings** in the Setup menu to restore the predefined factory settings, see p. 7.



Sound menu

1. Press the **MENU** key to display/cancel the **MAIN MENU**.
2. Use the cursor in the up/down directions to select the **SOUND** menu.
3. Use the cursor in the up/down, left/right directions to select the menu item.
4. Use the **OK** key to activate.
5. Press the **MENU** key repeatedly to return or to switch the menu off.



The modified adjustments for Volume, Balance, and Graphic equalizer are automatically stored for all TV channels.
Select **Factory settings** in the Setup menu to restore the predefined factory settings, see p. 7.

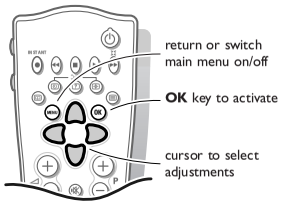
Graphic Equalizer
Here you can select the preferred sound setting which corresponds with the personal sound settings.

Headphone volume
See Connect Peripheral Equipment, p. 23, for the connection of the headphone.

AVL (Automatic Volume Leveller)
AVL automatically controls the volume level to avoid too large level differences, especially when switching to another programme or during commercial breaks.
AVL will reduce the dynamics of the sound. To maintain original dynamics, use the Delta volume feature.

Delta volume
Here you may adjust the volume differences of each selected TV channel or external device separately. This can compensate volume differences between different broadcasters.
Use the **- P +** keys to compare to the volume of other TV channels or externals.

Virtual Dolby effect
Virtual Dolby enables you to experience the effect of Dolby Surround Pro Logic without the need of having rear speakers connected or activated.
Select the level of **Virtual Dolby effect** with the cursor left/right.



Features menu

1. Press the **MENU** key to display/cancel the **MAIN MENU**.
2. Use the cursor in the up/down directions to select the **FEATURES** menu.
3. Use the cursor in the up/down, left/right directions to select the menu item.
4. Use the **OK** key to activate.
5. Press the **MENU** key repeatedly to return or to switch the menu off.

Sleeptimer
With the sleeptimer you can set a time period after which the TV should switch itself to standby.
The counter runs from **Off** up to **180 min.**
One minute before the TV is set to go to standby, the remaining seconds appear on screen. Not visible in dual screen mode. You can always switch off your set earlier or change the set time.

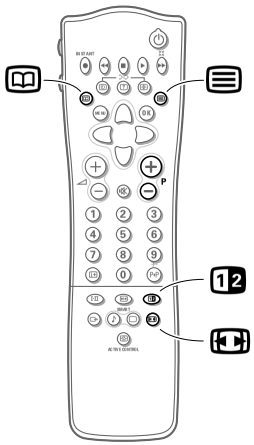
Child lock
If the child lock is on, the TV can only be switched on with the remote control. The **P** - and + keys on top of the TV cannot be used to select a TV channel. In this way you can prevent unauthorised use of your TV.
If the message **Child lock On** appears, the child lock must be switched off before you can use the **P** - and + keys on top of the TV to select a TV channel.

Subtitle
TV channels with teletext often transmit certain programmes with subtitling. See Teletext, Continuous Subtitles, p. 21 how to select the proper subtitle page from the teletext index.
Select **Subtitle On** or **Off**.

Press the **MENU** key to switch off the Features menu.

Programme list

1. Press the **MENU** key to display/cancel the **MAIN MENU**.
2. Select **PROGRAMMES** with the cursor up/down.
3. Press the cursor right to display an overview of all the TV channels installed.
4. Press the cursor up/down to run through the list and press **OK** to select the desired TV channel.
5. Press the **MENU** key to switch off the Programme list.



Dual Screen

1. Press the 1 2 key to switch on Dual Screen.
   The TV screen is divided into 2 parts:
   - the left side for the normal main picture,
   - the right side for teletext broadcast by the selected TV channel or for NEXTVIEW/Teletext Guide.

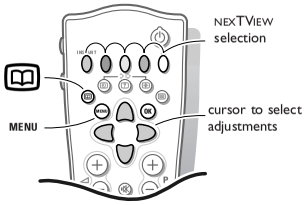
   To operate NEXTVIEW/Teletext Guide, see p. 15.
   To operate teletext, see p. 19.
   If Dual Screen is Off, the picture, teletext or NEXTVIEW/Teletext Guide are displayed full screen.
2. Press the key to select a vertical squeezed or a non vertical squeezed picture size
3. Press **+ P -** to run through the teletext pages.
4. When in Teletext Dual Screen, press the key to return to a full picture screen or press the 1 2 key to return to a full Teletext screen.
5. When in NEXTVIEW/Teletext Guide Dual Screen, press the key to return to a full picture screen or press the 1 2 key to return to a full NEXTVIEW/Teletext Guide screen.

NEXTVIEW / Teletext Guide

Today, most broadcasters in Europe, are offering teletext pages containing their programme schedule of today. These pages can be requested by switching the TV to **Teletext Guide**.
An increasing number of broadcasters are offering an extended programme guide service called **NEXTVIEW.** NEXTVIEW is a new way of presenting programme schedules and offers more features than common teletext.
With NEXTVIEW it is possible to show for instance all the movies coming tonight.

Both facilities are integrated in this TV: NEXTVIEW and Teletext Programme Guide. If a TV channel supports NEXTVIEW then the TV will automatically present the NEXTVIEW programme schedule. If the TV channel supports just teletext, then the TV will switch automatically to Teletext Guide.
Both facilities are offering the same functions: record, remind and info.
However in case of Teletext Guide the broadcaster is responsible if these functions are possible.
You can search for the programmes you want to watch up to 7 days in advance.
It is also possible to search for a programme by theme, e.g. sport, movie, etc.
Once a programme has been selected it can be tagged, to remind you, or to record on the video recorder automatically (provided the video recorder is equipped with NEXTVIEWLink Level 2.0), once, daily, weekly or series.
Teletext Guide/NEXTVIEW also allows direct access to detailed information about programmes if provided by the broadcaster.

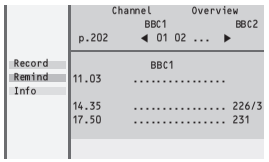
The broadcaster is responsible for the contents of the information.
The TV is responsible for the capture of that information and for the presentation to the user.



Use of the Teletext Guide/NEXTVIEW menus

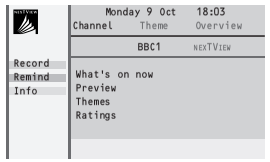
1. Press the key on the remote control to display/cancel the Teletext Guide/ NEXTVIEW menu.
2. Use the cursor in the up/down, left/right directions to select the date, **CHANNEL** for the channel guide, **THEME** for the theme guide, **OVERVIEW** for an overview of all the programmes which are marked as reminders or for recording, the programme guide page number or to enter the programme list.

Teletext Guide

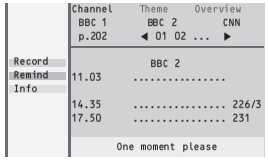


3. Enter the proper programme guide page number with the digit keys or with the **– P +** keys.
4. Press the cursor left/right to run through the subpages.
5. Select a programme with the cursor up/down.
6. Press one of the colour keys to select one of the basic functions (if available); **record**, **remind**, **info**. See Basic functions further on.
7. Press the **OK** key to return to the header area again.

NEXTVIEW



3. Select a programme with the cursor up/down.
4. Press one of the colour keys to select one of the basic functions (if available); **record**, **remind**, **info**. See Basic functions further on.
5. Press the **OK** key to return to the header area again.



Teletext guide

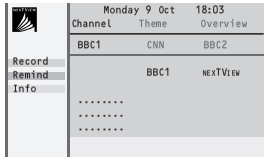
TV channels which broadcast teletext also transmit a page with the programme guide of the day. For each selected TV channel the programme guide page can be selected with the key:

- automatically if the selected TV channel supports services like PDC (Programme Delivery Control) or MIP (Magazine Inventory Page).
- if automatic pre-selection is not possible then the index page is displayed and the proper programme guide page number of the selected TV channel has to be entered with the digit keys.

The programme guide page will be stored automatically only if it satisfies Video Programming via Teletext (VPT) requirements.

Every time you press the key, the programme guide page of the selected TV channel will be available if the TV channel does not support NEXTVIEW.

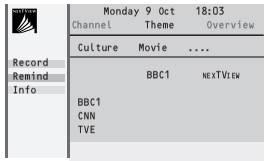
The function items record, remind and info, corresponding with the coloured keys, become highlighted if the displayed programme page satisfies the Video Programming via Teletext (VPT) requirements. Select a programme item and press one of the function keys, e.g. Record or Remind. See Basic functions further on.
The Info item is enabled if the selected programme contains a page number with an optional subcode referring to a page with more info about the programme.



NEXTVIEW modes to sort and represent information

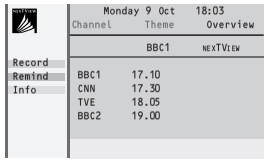
Channel

The Channel guide provides an overview of all programmes that are broadcast by a single channel during one day.
Already passed programmes can be made visible via cursor up.
The list will start with the earliest broadcast programme.
With cursor left/right another favourite TV channel can be selected.



Theme

The theme guide displays a list of all programmes at the selected date, that matches with the selected category (news, sport, culture, movies, …).
The default starting item will be the current or next programme on the current TV channel.
The **THEME** selection is only present if programmes in the TV guide have defined themes.

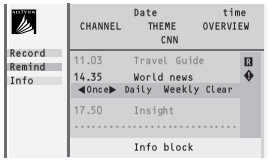


Overview

The Overview menu provides a list of programmes that are marked as reminders or to be recorded each day.
When more than one programme to be recorded has an overlap in time, these programmes will be marked by a red colour.

After the programme has been broadcast, all items set for once will be deleted from the list the following day. This menu can be used to change a reminder or recorder.

Note: the TV will automatically interpret the broadcast time (as shown on the teletext guide) of your selected programme into the correct local time and date.



Basic functions

The functions Record, Remind and Info can be activated with the corresponding colour keys on the remote control.
If the function is not available, then the text is shown at reduced brightness.
Select a programme with the cursor up/down.

Record R or Remind

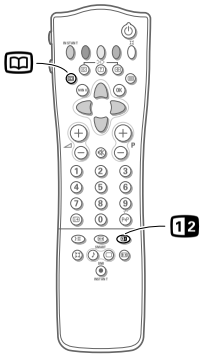
1. Press the red colour key to activate **Record** or the green colour key to activate **Remind.**
   If the programme number of the broadcaster is not yet known, a message appears with the request to input the correct programme number with the cursor left/right and press OK.
   A small menu pops up in which you can choose the interval: once, daily or weekly, or clear an earlier made record or remind setting. The default interval is set to **Once**. If a programme is an episode of a series, it is identified by the system and the options **daily** and **weekly** are replaced by the option **series**. In this case the system identifies when the next episode of the series will be broadcast. This is not possible in the Teletext guide.
2. Use the cursor in the left/right directions to select the interval.
   The colour of the tag refers to the interval.
3. Press the **OK** key.

When **Record** R is activated:
Storing is displayed to indicate the video recorder is programmed.
When **Remind** is activated:
- a message will be displayed the moment the tagged programme with starts, when watching the TV later on.
- the TV switches on the moment the tagged programme with starts, when the TV is in standby.

Note: Recordings and reminders are not possible when the broadcaster does not transmit dates and times of the programmes.
*The message **No TV programming possible** appears.*
Make sure you are on the TV programming page.

Info

1. Press the yellow colour key to activate **Info**.
   Advertisements or information relating to the selected programme are displayed. In some cases all of the information does not fit on the screen. Use the cursor up/down to browse through all the information.
2. Press the yellow colour key again to switch off the information.



Select Picture/NEXTVIEW-Teletext Guide

Press the key.
Press the 1 2 key.
The screen is divided into two parts: the left side for the normal main picture, the right side for NEXTVIEW/Teletext Guide.
Press the 1 2 key to return to a full NEXTVIEW/Teletext guide screen, or press the key to return to a full picture screen.

Acquisition and updating of NEXTVIEW information

Acquisition and updating of NEXTVIEW is done when you are watching a TV channel supporting NEXTVIEW.

Video recorder restrictions with NEXTVIEW

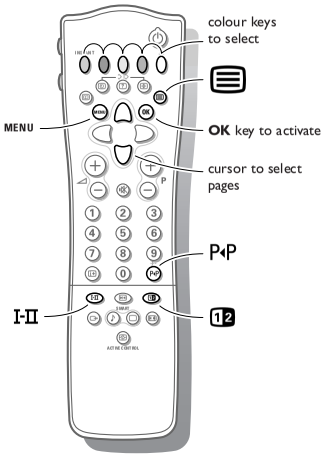
The **Record** item and the automatic recording will only be present and possible if your video recorder is equipped with NEXTVIEWLink.
Your video recorder should be connected to **EXTERNAL 2**. See Connect Peripheral Equipment, p. 22.

The daily, weekly and series options, the number of recordings set and the way overlapping recordings are managed, depend on the type of video recorder you have. When all video recorder timers are full, the item **Record** in the menu will not be present.

Upload video recorder overview
When the TV is switched on, the timer recordings are uploaded to the TV to check if any manual addition or deletions have been done. This is shown in the overview.
The video recorder manages and removes timer recordings when performed.

Some NEXTVIEWLink video recorders do not allow a daily programming of the recording to start on a Saturday or Sunday. In this case the item **daily** will be removed from the menu on those days.

Teletext



Most TV channels broadcast information via teletext.
Each channel which broadcasts teletext transmits a page with information on how to use its teletext system. Look for the teletext page with the main index (usually p. 100).
Depending on the TV channel, teletext is transmitted in different systems.
The colours used in the options line correspond with the colour keys of your remote control.

About Easy Text

Easy Text considerably reduces the waiting time (on condition that the teletext broadcast of the particular TV channel is received for at least half a minute) by :

- a direct selection of previous and following pages which are in transmission and of the pages referred to in the options line
- a habit watcher list: frequently used pages are put automatically in a list of preferred pages, so that they are immediately available
- the precapturing of the page numbers referred to in the displayed page
- the precapturing of all the subpages.

Switch Teletext on and off

Press to switch the teletext on or off.
The main index page appears on the screen together with two information lines at the top and one option line at the bottom of the screen.

Remark: if the displayed teletext characters on screen do not correspond with the characters used in your language, press the I-II key repeatedly to select Language group 1 or 2.

Select a Teletext page

With the digit keys
Enter the desired page number with the digit keys.
The page counter seeks the page or the page appears immediately when the page number has been stored in the memory.
A message appears when you have entered a non existent or incorrect page number. Page numbers beginning with 0 or 9 do not exist. Choose another number.

With the option line
Select with the colour keys, corresponding to the coloured options at the bottom of the screen, the desired subject.

Select Picture/Teletext

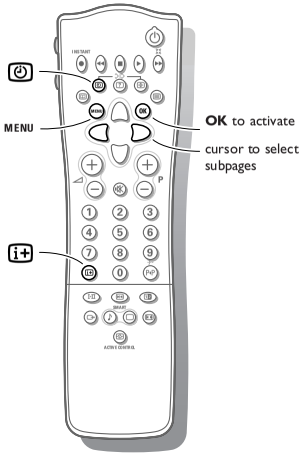
Select a TV channel which broadcasts teletext.
Press the 1 2 key.
The screen is divided into two parts:
the left side for the normal main picture,
the right side for teletext broadcast by the selected TV channel.
Press the key to return to a full screen picture or press the 1 2 key to return to a full teletext picture.

Quickly run through the teletext pages

Press the cursor up/down or the **- P +** key to run through the previous or the following pages.

Select the previously selected teletext page

Press the P↩P key.



Select the index teletext page

Press the white colour key to display the main index (usually p.100).

Only for T.O.P teletext broadcasts :
T.O.P orders the pages in categories and adds other possibilities of enhancing ease of use.
Press i+. A T.O.P. overview of the teletext subjects available is displayed.
Not all TV channels broadcast T.O.P. teletext. When the teletext system is not T.O.P. teletext, a message appears at the top of the screen.
Select with the cursor up/down, left/right the desired subject and press the **OK** key.

Select subpages

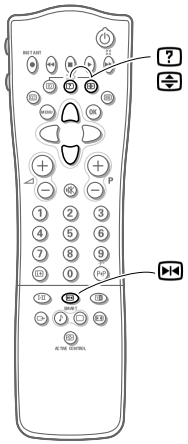
When a selected teletext page consists of different subpages, one of the subpages appears on the screen.
The coloured number in the first information line refers to the displayed subpage.
The other subpages can be selected in 2 ways :

With the cursor left/right
The other subpage numbers appear in white as soon as the transmission has found them. They are stored in the memory so that they are available while the teletext page is on screen.
Select with the cursor left/right the previous or the following subpage.

With the ⏻ key
• Enter the subpage number yourself:
Press ⏻. Enter the desired subpage with the digit keys : e.g. 3 for the third page of seven subpages.
The TV searches for the selected subpage.

• Automatically rotating subpages:
Press ⏻ again to cancel the entered digit key for the subpage.
Now the subpages rotate automatically.

Press ⏻ again to select the subpages with the cursor left/right again.



Special teletext functions

Hold
Press ⏭ to stop the automatically rotating of the subpages or to stop the page counter from seeking when you have entered a wrong page number or when the page is not available.
Enter another page number.

Enlarge
Press ⇳ repeatedly to display the upper part, the lower part and then to return to the normal page size. When the upper part is displayed, you can scroll the text, line by line using the cursor up/down.

Reveal
Press ? to reveal/conceal the hidden information, such as solutions to riddles and puzzles.

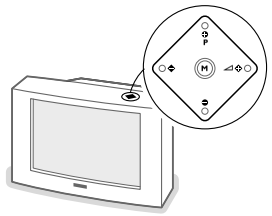
Select Continuous Subtitles

TV channels with teletext often transmit programmes with subtitling. For each TV channel you can store a subtitle page which will be displayed continuously if the programme being broadcast is transmitted with subtitles.

Switch on teletext and select the proper subtitle page from the index.
Switch off teletext.
Now the subtitle page is stored for the selected TV channel.

Once subtitles have been stored and **Subtitle On** has been selected they will automatically be displayed on the selected TV channel if subtitles are in the transmission.
Select **Subtitle On** or **Off** in the Features menu, see p. 13.
The subtitle symbol ▭ appears when **Subtitle On** is selected.

Remark: you are in teletext mode, so only teletext functions are available.



Keys on top of the TV

Should your remote control be lost or broken you can still change some of the basic picture settings with the keys on top of the TV.

Press the **M** key repeatedly to select **Volume**, **Brightness**, **Colour**, **Contrast**.
Press the **P** - or + keys to carry out the selected adjustment.
When the menu adjustment is not displayed, the **P-** or **+** keys enable you to select the TV channels, the ◿ - or + keys to adjust the volume.

The selected adjustment automatically switches off when no action has been executed for 10 seconds.

Connect Peripheral Equipment

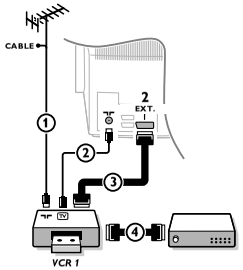
There is a wide range of audio and video equipment that can be connected to your TV. The following connection diagrams show you how to connect them.

Video recorder

Connect the aerial cables ①, ② and, to obtain the optimum picture quality, eurocable ③ as shown opposite.

easyLINK

If your video recorder is provided with the EasyLink function, the eurocable supplied with it should be connected to **EXTERNAL 2** *to benefit from the EasyLink functionality.*



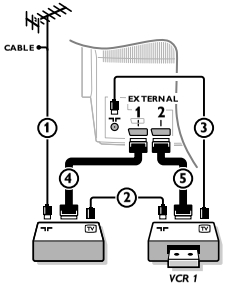
If the eurocable ③ is not used the following steps are required:

Search for and store the test signal of the video recorder

1. Unplug the aerial cable ① from the aerial socket of your video recorder.
2. Switch on your TV and put the video recorder on the test signal. (See the handbook for your video recorder.)
3. Search for the test signal of your video recorder in the same way as you searched for and stored the TV signals. See Installation, Searching for and storing TV channels, Manual installation, p. 5.
4. Store the test signal under programme number 0 or between 90 and 99.
5. Replace the aerial cable in the aerial socket of your video recorder after you have stored the test signal.

Decoder and video recorder
Connect a eurocable ④ to your decoder and to the special euroconnector of your video recorder. See also the video recorder handbook.
See Define Decoder/Descrambler prog. numbers, p. 7.
You can also connect your decoder directly to **EXTERNAL 1** or **2** with a eurocable.

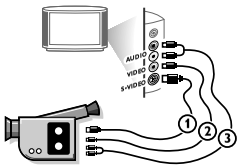
Video recorder and other peripherals (except Digital Sources)



1. Connect the aerial cables ①, ② and ③ as shown opposite. Better picture quality can be obtained if you also connect eurocable ⑤ to **EXTERNAL 2** and a eurocable ④ to **EXTERNAL 1** or **EXTERNAL 3**.
2. Look for the test signal of your peripheral in the same way as you do for a video recorder.

When a video recorder is connected to **EXTERNAL 1** *you can only record a programme from your TV.*
Only when a video recorder is connected to **EXTERNAL 2** *it is possible to record a programme from your TV as well as from other connected equipment. See Record with your video recorder, p. 26.*

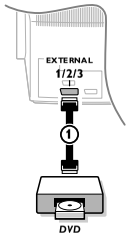
Note: EXTERNAL 1 can handle CVBS and RGB, EXTERNAL 2 CVBS and Y/C and RGB, EXTERNAL 3 only CVBS.



Camera & camcorder

1. Connect your camera or camcorder to sockets at the right side of your TV.
2. Connect the equipment to **VIDEO** ② and **AUDIO L** ③ for mono equipment.
3. For stereo equipment also connect **AUDIO R** ③.

S-VHS quality with an S-VHS camcorder is obtained by connecting the S-VHS cables with the **S-VIDEO** input ① and **AUDIO** inputs ③.



Digital equipment (DVD, digital satellite tuner,...)

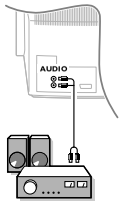
Connect your digital equipment with a eurocable ① to one of the euroconnectors (**EXT1**, **EXT2** or **EXT3**), or with a cinch cable to the **VIDEO** input at the right side of the TV (see illustration above).

Note: the low quality of some digital picture material may be the cause of digital image distortion. In this case select ***Eco*** *under the* ***SMART PICTURE*** *key on the remote control as this setting is intended to improve distorted picture quality.*

Headphone

1. Insert the plug into the headphone socket at the right side of the TV.
2. Press on the remote control to switch off the internal loudspeakers of the TV.
The headphone impedance must be between 8 and 4000 Ohm.
The headphone socket has a 3.5 mm jack.

In the **SOUND** menu select **Headphone volume** to adjust the headphone volume, see p. 12.



Audio equipment / Amplifier

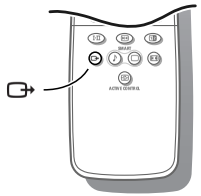
Connect the audio cables to the audio input of your audio equipment and to **AUDIO L** and **R** at the back of your TV.

You can listen to your TV sound via your audio equipment.

If you want to connect more equipment to your TV, consult your dealer.

To select connected equipment

easy LINK



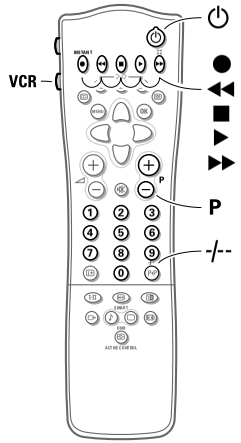
If the TV is connected to a video recorder with the EasyLink function, in some cases the TV will be switched on, even when it was in standby. (E.g. playback tape,..)
This is not possible when Child lock On is selected.

Equipment connected with an aerial cable only :
Select the programme number under which you have stored the test signal with the digit keys.

Equipment connected to a euroconnector or to the right side of the TV
Press the ⇨ key repeatedly to select **EXT1**, **EXT2**, **EXT3** or **FRONT**, according to where you connected your equipment at the back or the right side of your TV.
Remark : Most equipment (decoder, video recorder, satellite receiver) carries out the switching itself.

If you want to change to TV channels?
Enter the programme number of the TV channel which you want to watch with the digit keys or press the ⇨ key repeatedly to select **TV**.

Audio and video equipment keys



Most of the audio and video equipment from our range of products can be operated with the remote control of your TV.

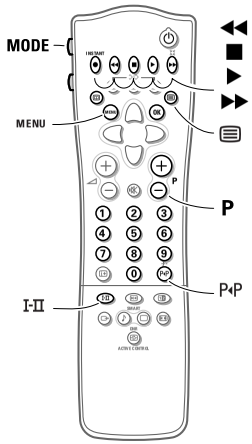
Video recorder
Keep the **VCR** key on the left side of the remote control pressed and simultaneously press:

●	for record,
◀◀	for rewind,
■	for stop,
▶	for play,
▶▶	for fast forward,
-/--	for selecting 1- or 2-digit programme numbers from the video recorder,
- P +	for sequential programme selection from the video recorder tuner,
0 to 9	to select a programme number from your video recorder tuner,
⏻	to switch the video recorder to standby

These keys function with equipment which use the RC5 signalling standard.

easy LINK

If your video recorder has the EasyLink function, the key **INSTANT** ● *for recording, can be operated in the TV mode.*
If your EasyLink video recorder has the system standby function, when you press the ⏻ key for 3 seconds, both TV and the video recorder are switched to standby.



Satellite receiver
Press the **OK** key simultaneously with the digit key 1.
Now you can operate your satellite receiver with the remote control of your TV.

Keep the **MODE** key on the left side of the remote control pressed and simultaneously press:

MENU to switch the **SAT** menu on or off

These keys function with equipment which use the RC5 signalling standard.

DVD player
Press the **OK** simultaneously with the digit key 2.
Now you can operate your DVD player with the remote control of your TV.

Keep the **MODE** key on the left side of the remote control pressed and simultaneously press:

MENU	to switch the DVD menu on or off
☰	to select a DVD title
P•P	to select a DVD chapter
I-II	to select your choice of audio language
◀◀	to search down
■	stop
▶	play
▶▶	to search forward
0-9	to select a programme number from your DVD
OK	to enter the selected menu item

●, ⏲, ?, ⇳, ⇨ have no function

Note: after replacing the batteries the default operational equipment is the satellite receiver.

These keys function with equipment which use the RC6 signalling standard.

Record with your video recorder

To record S-VHS quality, connect an S-VHS peripheral directly to the video recorder.

Record a TV programme

1. Select the programme number on your video recorder.
2. Set your video recorder to record.
   See the handbook for your video recorder.

Switching programme numbers on your TV does not disturb recording !

Record a programme on your video recorder connected to EXTERNAL 2 from Audio/Video equipment connected to EXTERNAL 1, EXTERNAL 3 or to sockets on the right side of the TV

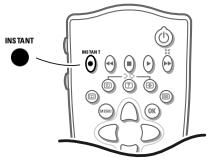
1. Switch on the equipment.
2. Select the right external on your video recorder.
3. Set your video recorder to record.
   You record what you are watching on the screen.

Do not switch programme numbers or do not switch off your TV when you are recording !

Record with your video recorder with EasyLink

easy LINK

If you have connected an S-VHS video recorder provided with the EasyLink function, you can record S-VHS-quality from an S-VHS peripheral connected to the right side of the TV. (E.g. from an S-VHS camcorder.)



In TV mode, it is possible to start a direct recording of the programme which is being displayed on the TV screen.
Press the **INSTANT** ● *record key of the remote control.*
The video recorder switches on from standby and a message of what is being recorded appears on the screen.
The video recorder starts recording the programme you are watching.
Switching programme numbers on your TV does not disturb recording !

When recording a programme from a peripheral connected to EXTERNAL 1, 3 or FRONT, you can not select another TV programme on the screen.
To watch TV programmes again, press the programme number you want to select twice.
Attention: the recording is stopped and your video recorder switches to standby.

Record with your video recorder with NEXTVIEWLink

If your video recorder is equipped with NEXTVIEWLink, and you tagged one or more programmes to be recorded automatically in the NEXTVIEW mode, it is not necessary for the TV to be in the standby mode or switched on for the recording to start.

Tips

Care of the screen
Clean the TV with a slightly damp soft cloth. Do not use abrasive solvent as it can damage the TV screen.

Poor Picture
- Have you selected the correct TV system?
- Is your TV or house aerial located too close to loudspeakers, non-earthed audio equipment or neon lights, etc.?
- Mountains or high buildings can cause double pictures or ghost images. Sometimes you can improve the picture quality by changing the direction of the aerial.
- Is the picture or teletext unrecognisable? Check if you have entered the correct frequency. See Installation, p. 5.
- Are brightness and contrast out of adjustment? Select Factory settings in the Setup menu, p. 7.
- Sometimes poor picture quality is possible when having activated an S-VHS camera or camcorder connected to the right side of your TV and another peripheral is connected to **EXT1** or **EXT2** at the same time. In this case switch off one of the other peripherals.

No picture
- Is the aerial connected properly?
- Are the plugs tightly connected in the aerial socket?
- Is the aerial cable in good condition and does it have suitable plugs?
- Are the connection facilities to a possible second TV in good condition? If in doubt, consult your dealer.

No sound
- No sound on any channel? Check the volume isn't at minimum.
- Is the sound interrupted with the mute key 🔇?

Remote control
If your TV no longer responds to the remote control, the batteries may be dead.
You can still use the **M** key and the -/+ keys at the top of your TV.

Menu
Have you selected the wrong menu? Press the **MENU** key again to exit from the menu.

No solution
Switch your TV off and then on again once.
Never attempt to repair a defective TV yourself.
Check with your dealer or call a TV technician.

End of life directives
Philips is paying a lot of attention to produce environmentally-friendly in green focal areas. Your new TV contains materials which can be recycled and reused.
At the end of its life specialised companies can dismantle the discarded TV to concentrate the reusable materials and to minimise the amount of materials to be disposed of.
Please ensure you dispose of your old TV according to local regulations.

How to dispose of batteries?
The batteries supplied do not contain the heavy metals mercury and cadmium. Nevertheless in many countries batteries may not be disposed of with your household waste. Please ensure you dispose of batteries according to local regulations.

Index

a ACI, *5*
active control, *10*
automatic installation, *5*
auto format, *7*
auto surround, *8*
AVL, *12*
b bilingual broadcast, *10*
c camcorder, *23*
child lock, *13*
continuous subtitles, *21*
country, *4*
d decoder/descrambler, *7*
delta volume, *12*
digital options, *11*
double lines, *11*
dual screen, *14*
DVD, *25*
dynamic contrast, *11*
e easy text, *19*
eurocable, *22*
f factory settings, *7*
favourite programmes, *6*
freeze, *10*
frequency, *5*
g give name, *6*
graphic equalizer, *12*
h headphone, *23*
hue, *11*
i incredible surround, *9*
info on screen, *9*
information line, *7*
interrupt the sound, *9*
l language, *4*
m manual installation, *5*
menu language, *4*
n natural motion, *11*
NEXTVIEW, *15*
nicam, *10*
p picture adjustments, *11*
picture format, *10*
picture tilt, *7*
programme selection, *9*
programme list, *13*
r recording, *26*
reshuffle, *6*
s satellite receiver, *26*
search for TV channels, *5*
setup, *7*
sleeptimer, *13*
smart picture and sound, *10*
sound adjustments, *12*
stereo, *10*
store TV channels, *4*
subpages teletext, *20*
S-VHS, *26*
switch TV on, *3*
t teletext, *19*
v video recorder, *22*
Virtual Dolby Surround, *9*
volume, *9*

Glossary

100 Hz
100 Hertz provides a superior solution to the problem of picture flicker which is particularly noticeable with larger screen sizes. In a conventional TV, the picture area is scanned 50 times a second (50 Hertz) – a frequency which is still detectable by the human eye in the form of a flickering picture. In 100 Hertz sets, the picture area is scanned at a rate of 100 times per second (100 Hertz). At this frequency, the eye cannot detect flicker, resulting in a clearer picture which is more relaxing to the eye.

Automatic Channel Installation (ACI)
Automatically installs all TV channels in the same order as offered by your cable company, provided of course that the data is transmitted. It also automatically includes programme number and programme name.
With ACI, channel installation is fully automatic, simple and fast.

Child lock
Feature to prevent unauthorised use of your TV.

Digital Scan
If you look at a television screen you will see small imperfections in the picture caused by line vibration. Digital Scan (an internal process) removes interline flicker. When combined with 100 Hz, you will see a totally stable image.

Easy Link
Digital 'intelligent' ESI bus-system between TV and VCR (Scart connection required). Turns source selection and control into a one-button operation.

EasyText
Teletext memory that automatically memorises Teletext pages and gives you instant access to them.

Euroconnector
A 21-pin connector system enabling you to simply connect various types of audio/video and computer equipment.

Menu
On-screen display of functions and facilities in a well-organised survey, which you can select using your remote control.

NEXTVIEW
NEXTVIEW is a new feature to assist the TV and VCR user in selecting the programmes she or he likes to watch from a television programme guide on the screen. It enables the user to see a description of every programme, and mark interesting programmes to be reminded (auto TV on) or recorded (NEXTVIEWLink video recorder required).

NTSC
The broadcasting system used in the USA, Japan and parts of South America and Southeast-Asia.

Smart Picture and Sound controls
Keys on the remote control to select predefined picture and sound settings.

Sleeptimer
Function with which you can set a time period after which the TV should switch itself to standby.

Picture Freeze
TV mode which allows you to "freeze" a certain image in order to study a specific detail at ease, e.g. to make notes of certain programme information like phone numbers.

Teletext
See also Easy Text
WST: World Standard Teletext.
FLOF: Full Level one Features. System applied by the BBC, RVE.... that provides a fast access to the teletext pages.
TOP: Table of (Teletext) Pages. German system for an easy access to the teletext pages.

Tint
TV-function to modify the general colour balance between cool and warm and to adjust it according to your personal preference.

Table of TV frequencies.
Frequenztabelle der Fernsehsender.
Liste des fréquences des émetteurs.
Frequentietabel TV-Zenders.
Tabella delle frequenze delle trasmittenti.
Lista de las frecuencias de las emisoras.
Lista das frequências dos emissores.
Liste over TV senderne.
Tabell over TV-frekvenser.

EUROPE	
CHANNEL	FREQ (MHz)
E2	48.25
E3	55.25
E4	62.25
E5	175.25
E6	182.25
E7	189.25
E8	196.25
E9	203.25
E10	210.25
E11	217.25
E12	224.25
S1	105.25
S2	112.25
S3	119.25
S4	126.25
S5	133.25
S6	140.25
S7	147.25
S8	154.25
S9	161.25
S10	168.25
S11	231.25
S12	238.25
S13	245.25
S14	252.25
S15	259.25
S16	266.25
S17	273.25
S18	280.25
S19	287.25
S20	294.25
H1	303.25
H2	311.25
H3	319.25
H4	327.25
H5	335.25
H6	343.25
H7	351.25
H8	359.25
H9	367.25
H10	375.25
H11	383.25
H12	391.25
H13	399.25
H14	407.25
H15	415.25
H16	423.25
H17	431.25
H18	439.25
H19	447.25
21	471.25
22	479.25
23	487.25
24	495.25
25	503.25
26	511.25
27	519.25
28	527.25
29	535.25
30	543.25
31	551.25
32	559.25
33	567.25
34	575.25
35	583.25
36	591.25
37	599.25
38	607.25
39	615.25
40	623.25
41	631.25
42	639.25
43	647.25
44	655.25
45	663.25
46	671.25
47	679.25
48	687.25
49	695.25
50	703.25
51	711.25
52	719.25
53	727.25
54	735.25
55	743.25
56	751.25
57	759.25
58	767.25
59	775.25
60	783.25
61	791.25
62	799.25
63	807.25
64	815.25
65	823.25
66	831.25
67	839.25
68	847.25
69	855.25

EASTERN EUROPE	
CANAL	FREQ (MHz)
R1	49.75
R2	59.25
R3	77.25
R4	85.25
R5	93.25
R 6	175.25
R 7	183.25
R 8	191.25
R 9	199.25
R10	207.25
R11	215.25
R12	223.25
S1	105.25
S2	112.25
S3	119.25
S4	126.25
S5	133.25
S6	140.25
S7	147.25
S8	154.25
S9	161.25
S10	168.25
S11	231.25
S12	238.25
S13	245.25
S14	252.25
S15	259.25
S16	266.25
S17	273.25
S18	280.25
S19	287.25
S20	294.25
H1	303.25
H2	311.25
H3	319.25
H4	327.25
H5	335.25
H6	343.25
H7	351.25
H8	359.25
H9	367.25
H10	375.25
H11	383.25
H12	391.25
H13	399.25
H14	407.25
H15	415.25
H16	423.25
H17	431.25
H18	439.25
H19	447.25
21	471.25
22	479.25
23	487.25
24	495.25
25	503.25
26	511.25
27	519.25
28	527.25
29	535.25
30	543.25
31	551.25
32	559.25
33	567.25
34	575.25
35	583.25
36	591.25
37	599.25
38	607.25
39	615.25
40	623.25
41	631.25
42	639.25
43	647.25
44	655.25
45	663.25
46	671.25
47	679.25
48	687.25
49	695.25
50	703.25
51	711.25
52	719.25
53	727.25
54	735.25
55	743.25
56	751.25
57	759.25
58	767.25
59	775.25
60	783.25
61	791.25
62	799.25
63	807.25
64	815.25
65	823.25
66	831.25
67	839.25
68	847.25
69	855.25

FRANCE	
CANAL	FREQ (MHz)
2	55.75
3	60.50
4	63.75
5	176.0
6	184.0
7	192.0
8	200.0
9	208.0
10	216.0
B	116.75
C	128.75
D	140.75
E	159.75
F	164.75
G	176.75
H	188.75
I	200.75
J	212.75
K	224.75
L	236.75
M	248.75
N	260.75
O	272.75
P	284.75
Q	296.75
H1	303.25
H2	311.25
H3	319.25
H4	327.25
H5	335.25
H6	343.25
H7	351.25
H8	359.25
H9	367.25
H10	375.25
H11	383.25
H12	391.25
H13	399.25
H14	407.25
H15	415.25
H16	423.25
H17	431.25
H18	439.25
H19	447.25
21	471.25
22	479.25
23	487.25
24	495.25
25	503.25
26	511.25
27	519.25
28	527.25
29	535.25
30	543.25
31	551.25
32	559.25
33	567.25
34	575.25
35	583.25
36	591.25
37	599.25
38	607.25
39	615.25
40	623.25
41	631.25
42	639.25
43	647.25
44	655.25
45	663.25
46	671.25
47	679.25
48	687.25
49	695.25
50	703.25
51	711.25
52	719.25
53	727.25
54	735.25
55	743.25
56	751.25
57	759.25
58	767.25
59	775.25
60	783.25
61	791.25
62	799.25
63	807.25
64	815.25
65	823.25
66	831.25
67	839.25
68	847.25
69	855.25

ITALY	
CANALE	FREQ (MHz)
A	53.75
B	62.25
C	82.25
D	175.25
E	183.75
F	192.25
G	201.25
H	210.25
H1	217.25
S1	105.25
S2	112.25
S3	119.25
S4	126.25
S5	133.25
S6	140.25
S7	147.25
S8	154.25
S9	161.25
S10	168.25
S11	231.25
S12	238.25
S13	245.25
S14	252.25
S15	259.25
S16	266.25
S17	273.25
S18	280.25
S19	287.25
S20	294.25
H1	303.25
H2	311.25
H3	319.25
H4	327.25
H5	335.25
H6	343.25
H7	351.25
H8	359.25
H9	367.25
H10	375.25
H11	383.25
H12	391.25
H13	399.25
H14	407.25
H15	415.25
H16	423.25
H17	431.25
H18	439.25
H19	447.25
21	471.25
22	479.25
23	487.25
24	495.25
25	503.25
26	511.25
27	519.25
28	527.25
29	535.25
30	543.25
31	551.25
32	559.25
33	567.25
34	575.25
35	583.25
36	591.25
37	599.25
38	607.25
39	615.25
40	623.25
41	631.25
42	639.25
43	647.25
44	655.25
45	663.25
46	671.25
47	679.25
48	687.25
49	695.25
50	703.25
51	711.25
52	719.25
53	727.25
54	735.25
55	743.25
56	751.25
57	759.25
58	767.25
59	775.25
60	783.25
61	791.25
62	799.25
63	807.25
64	815.25
65	823.25
66	831.25
67	839.25
68	847.25
69	855.25

Tabell över TV-frekvenser.
TV-taajuustaulukko.
Κατάλογος συχνοτήτων πομπών.
Список частот передатчиков.
A televizió–adóállomások frekvenciáinak a listája.
Lista częstotliwości stacji nadawczych.
Seznam frekvenčních pásem vysílačů.
Zoznam frekvenčných pásiem vysielačov.

GB
The frequencies used by a cable company may differ from the frequencies on the table. Consult your cable company or your dealer for detailed information.

D
In Kabelfernsehanlagen können Abweichungen von den in den Frequenztabellen aufgeführten Frequenzen vorkommen. Bitte wenden Sie sich an Ihren Fachhändler oder Ihre Kabelfernsehgesellschaft, die Ihnen die zutreffenden Frequenzen mitteilt.

F
Les fréquences utilisées par une société de télédistribution peuvent être différentes de celles sur la liste des fréquences. Consultez votre société de télédistribution ou votre revendeur pour des informations plus détaillées.

NL
De frequenties die gebruikt worden door een kabelmaatschappij kunnen verschillen van deze op de tabel. Raadpleeg uw kabelexploitant of uw handelaar voor meer informatie.

I
Le frequenze usate per una società di teledistribuzione possano essere differenti di quelle nella tabella. Consultate la società di teledistribuzione o il vostro rivenditore per informazione specifica.

E
Las frecuencias utilizadas por las empresas de distribución de señal por cable, pueden ser diferentes de las que se encuentran en esta tabla. Consulte con su compañía de distribución de televisión por cable o con su distribuidor para que le proporcionen una información más detallada.

P
As frequências utilizadas por uma sociedade de teledistribuição podem ser diferentes das indicadas na lista de frequências. Consultar a sociedade de teledistribuição ou o vendedor para informações mais detalhadas.

DK
Frekvenser benyttet af kabel operatører kan være afvigende fra disse, kontakt deres kabel operator eller forhandler for nærmere informa-tion.

N
Frekvensene som benyttes pa et kabelnett kan avvike fra de som er oppført i tabellen. Kontakt ditt kabel-TV selskap eller din forhandler for nærmere opplysninger.

S
Frekvenserna som används i kabel-TV-näten kan avvika från frekvenserna i tabellen. Kontakta ditt kabel-TV-bolag eller din radiohandlare för vidare information.

SF
Kaapeliyhtiöden käyttämät taajuudet voivat poiketa taulukossa olevista taajuuksista. Tarkat tiedot saat kaapeliyhtiöstä tai myyjältä.

GR
Οι συχνότητες που χρησιμοποιούνται από μια εταιρεία τηλεμετάδοσης είναι δυνατόν να είναι διαφορετικές από αυτές που περιέχει ο πιπάλογος. (Συμβουλευθείτε την εταιρεία τηλεμετάδοσης ή τον πωλητή για λεπτομερέστερες πληροφορίες).

CEI
Частоты на которых передаёт телекампания могут отличаться от частот на данной таблице. (Обратиться к Вашей телекампании или Вашему продавцу за дополнительной информацией.

H
Egy televizió–adóállomás sugárzáshoz használt frekvenciatartományai lehetnek a táblázatban közöltektől eltérőek is. (Ahban az esetben, ha bővebb információkra van szüksége, forduljon az eladóhoz.)

PL
Operator sieci telewizyjnej może stosować inne częstotliwości, niż te, które figurują na tablicy (bardziej szczegółowych informacji na ten temat zasięgnąć u operatora lub sprzedawcy).

CZ
Frekvence používané některými televizními společnost–mi se mohou lišit od údajů uvedených v tomto seznamu. Informujte se blíže u příslušné společnosti nebo v prode–jně, kde jste televizor koupili.

SK
Frekvencie používané niektorými spoločnosťami televízneho prenosu sa môžu líšiť od údajov uvedených v tomto zozname. Informujte sa bližšie u príslušnej spoločnosti alebo v predajni, kde ste televízor kúpili.

4. Mechanical Instructions

Note: Figures below can deviate slightly from the actual situation, due to the different set executions.

4.1 Access to the Service Connector (for ComPair)

1. Remove the 'Service Connector' cover (see Figure 4.1).
2. Connect the ComPair cable (for more info, see chapter 5).
3. Start ComPair and perform the diagnosis.

4.2 Rear Cover Removal

1. Remove all fixation screws [A] of the rear cover.
2. Use a knife (or other thin blade) to release the four fixation clamps [B] at the top of the TV-set. Press down until you here a click.
3. Now remove the rear cover.

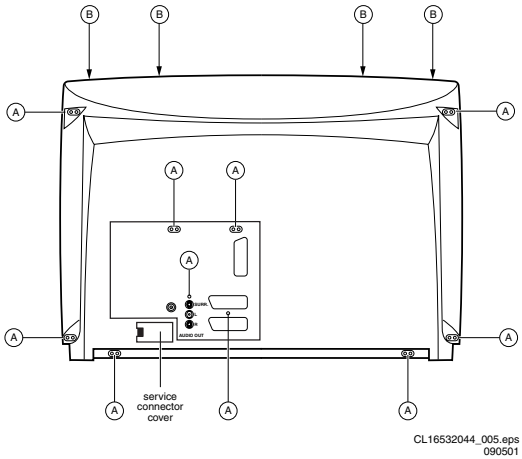


Figure 4-1 .eps

4.3 Print Removal

4.3.1 Large Signal Panel (LSP)

Service position 1: For better accessibility of the LSP, do the following (see Figure 4.2):
1. Remove the LSP-bracket from the bottom tray by pulling it backwards.
2. Hook the bracket in the first row of fixation holes of the bottom tray. In other words, reposition the bracket from [1] to [2].

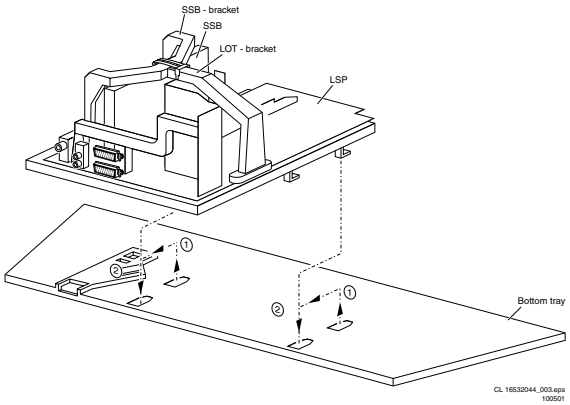


Figure 4-2 .eps

Service position 2: To get access to the bottom side (solder side) of the LSP, do the following (see Figure 4.3):
1. To disconnect the degaussing coil from the LSP, remove the cable from connector 1502 [1].
2. Release the wiring from their fixation clamps, in order to get room for repositioning the LSP.
3. Flip the LSP 90 degrees clockwise [2], and place it in the fixation hole at the left side of the bottom tray [3].

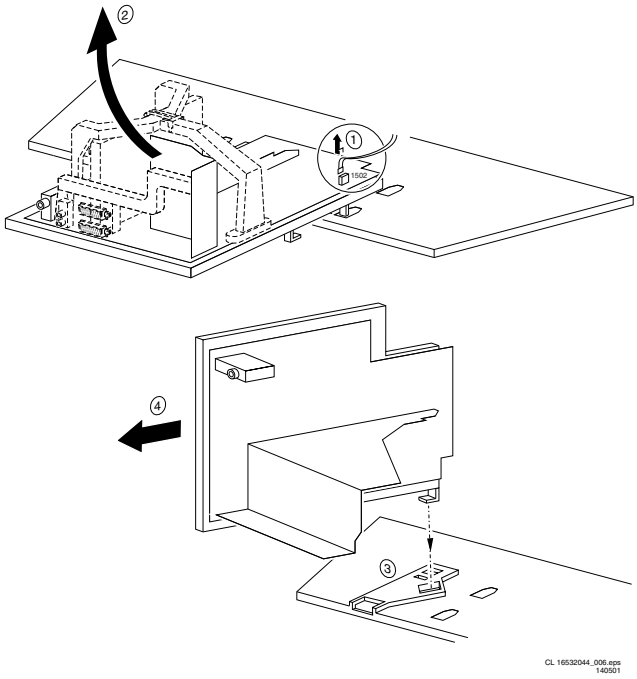


Figure 4-3 .eps

4.3.2 3rd SCART Panel

To remove the 3rd SCART module, do the following:
1. Remove the fixation screw [1].
2. To release the fixation peg, push it towards the CRT [2].
3. At the same time, pull the complete module away from the LSP [3]. It hinges in the LSP-bracket.
4. To remove the panel, disconnect the flat-cable from connector 1680 and remove the four panel screws [4].

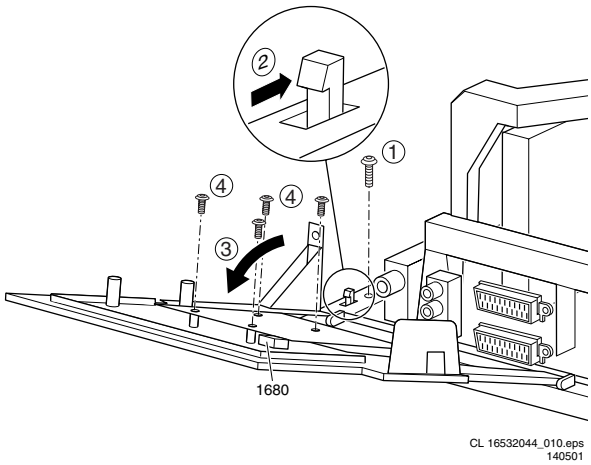


Figure 4-4 .eps

4.3.3 Small Signal Board (SSB)

In fact, there is no predefined service position for the SSB. Most test points are located on the A-side (side that is facing the tuner).
If you have to replace ICs, you must take the complete SSB module out of the SIMM-connector.

To get access to the SSB test points, do the following:
1. Put the LSP in service position 1 (as described above).
2. Remove the fixation screw, which holds the SSB-bracket [1].
3. Release the clamping jaw at the top of the SSB bracket [2] and [3].
4. Push the two clamping lugs outwards, and pull the top of the bracket at the same time upwards [4] and [5].
5. Now you can remove the complete bracket. Push it, at the height of the LSP-bracket, towards the CRT [6] and lift it out of the LSP-bracket [7].

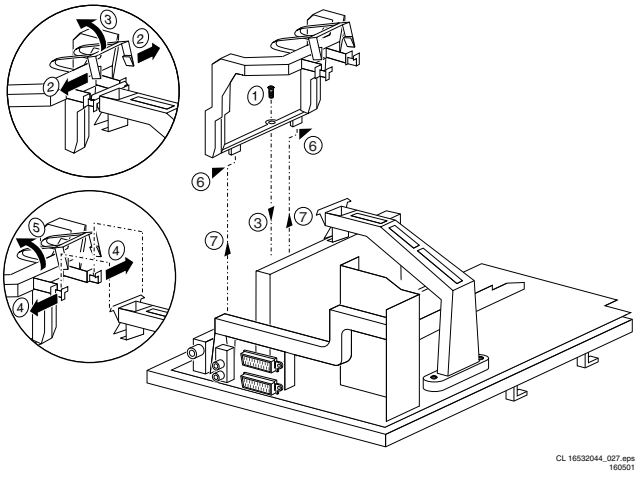


Figure 4-5 .eps

1. Push the top of the SSB towards the LOT [1].
2. Due to the pressure, the two metal clamps at both sides of the SIMM-connector will release [2].
3. Take the complete SSB out [3].

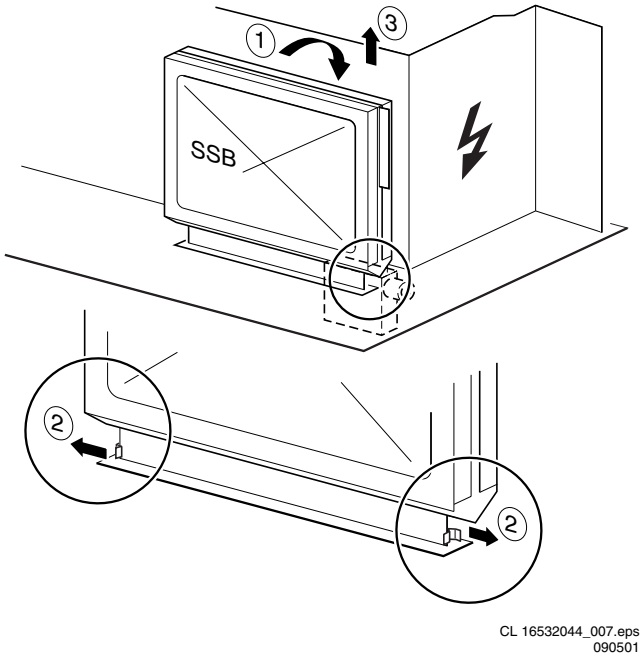


Figure 4-6 .eps

1. Once you have taken out the SSB, remove the A-side shielding [2]. Sometimes it is necessary to unsolder some solder-tags first [1].
2. Now replace the SSB module in the SIMM-connector in reverse order.

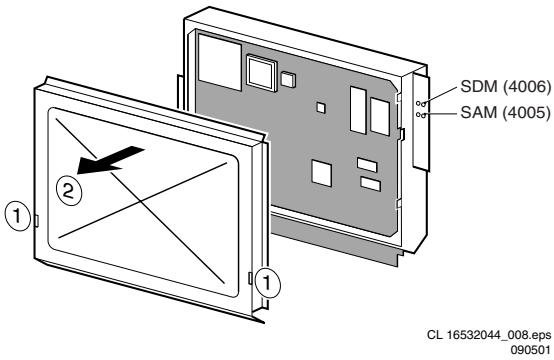


Figure 4-7

Note 1: For better access to the SSB, it is possible to order an 'extension board' under number 9965 000 07933.
Note 2: If necessary for the measurement, put the LSP in 'service position 2' (as described above).

4.3.4 Top Control Panel

1. Remove the two fixation screws.
2. Pull the board backward.

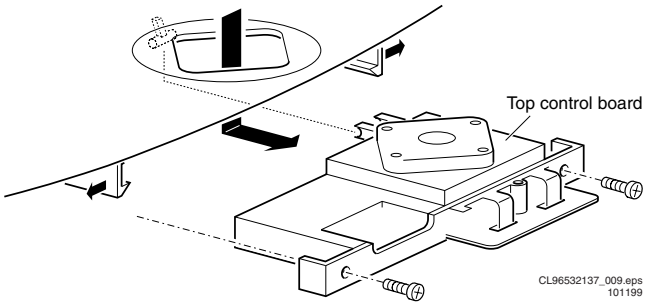


Figure 4-8

4.3.5 Side I/O Panel

1. Remove the two fixation screws [1].
2. Push the panel door inside and fix it in the lock [2].
3. Pull the module backward [3].
4. Now release the fixation clamps, in order to remove the print from its bracket.

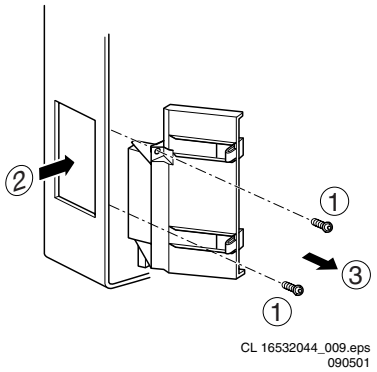


Figure 4-9 .eps

4.3.6 DAF Panel

1. Remove the fixation screw [1].
2. Push down the fixation clamp [2], and pull the complete bracket at the same time away from the CRT [3]. The module is now free from the LSP-bracket.
3. Release the fixation clamps [4], in order to remove the print from its bracket.

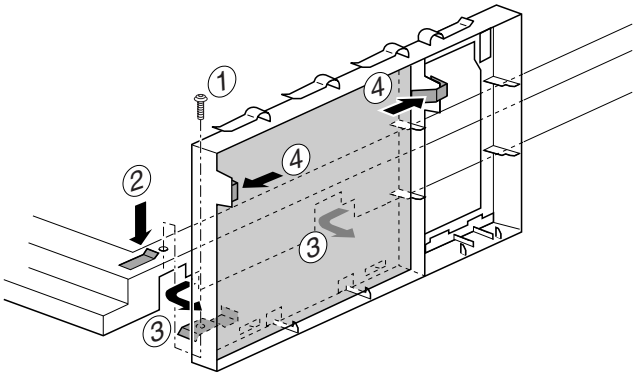


Figure 4-10 .eps

4.3.7 Mains Switch / LED Panel

1. Release the two fixation clamps by pushing them upward [1].
2. At the same time, pull the complete assy backward [2].
3. Now release the two fixation clamps [3], in order to remove the print from its bracket [4].

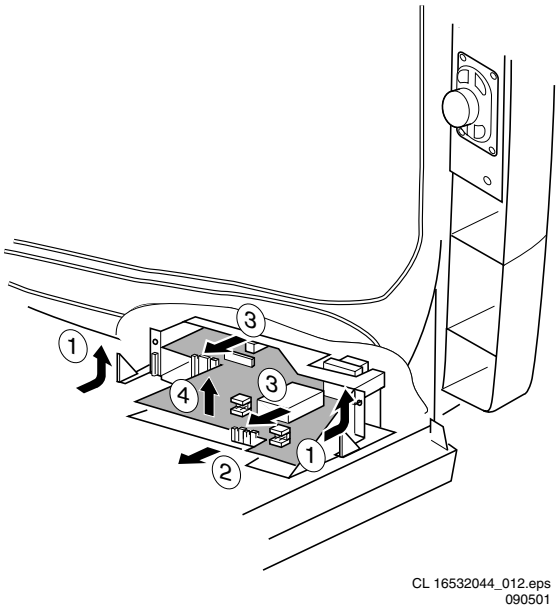


Figure 4-11 .eps

Note: If necessary, you can replace the light guide.

4.4 Rear Cover Assembly

Before you re-assemble the rear cover, perform the following checks:

- Check whether the mains cord is mounted correctly in the guiding brackets.
- Check whether all cables are placed in fixation clamps. This is very important due to the large 'hot' area of the set.

5. Service Modes, Error Codes and Fault Finding

Index of this chapter:
1. Test points.
2. Service Modes.
3. Problems and solving tips (related to CSM).
4. ComPair.
5. Error buffer.
6. The blinking LED procedure.
7. Protections.
8. Repair tips.

5.1 Test Points

The chassis is equipped with test points printed on the circuit board assemblies. They refer to the diagram letters. The numbering is in a logical sequence for diagnostics. Always start diagnosing (within a functional block), in the sequence of the relevant test points for that block.

Measurements are performed under the following conditions:
- Service Default Mode.
- Video: colour bar signal.
- Audio: 3 kHz left, 1 kHz right.

5.2 Service Modes

Service Default Mode (SDM) and Service Alignment Mode (SAM) offer several features for the service technician, while the Customer Service Menu (CSM) is used for communication between dealer and customer.

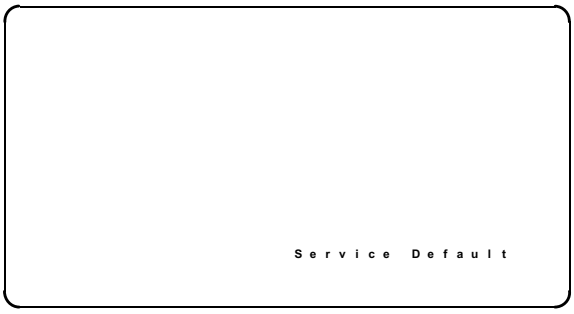
5.2.1 Service Default Mode (SDM)

Purpose
- To create a pre-defined setting, to get the same measurement results as given in this manual.
- To override SW protections.
- To start the blinking LED procedure.

Specifications
- Tuning frequency: 475.25 MHz for PAL/SECAM.
- Colour system: SECAM L for France or PAL B/G for the rest of Europe.
- All picture settings at 50 % (brightness, colour, contrast).
- All sound settings at 50 %, except volume at 25 %.
- All service-unfriendly modes (if present) are disabled, like:
  - (sleep) timer,
  - child/parental lock,
  - blue mute,
  - automatic volume limiter (AVL),
  - auto switch-off (when no 'IDENT' video signal was received for 10 minutes),
  - skip/blank of non-favorite pre-sets,
  - smart modes,
  - auto store of personal presets,
  - auto user menu time-out.

How to enter SDM
Use one of the following methods:
- Via a standard customer RC-transmitter : key in the code '062596' followed by the 'MENU' button (it is possible that, together with the SDM, the main menu will appear. To switch it off, push the 'MENU' button again).
- When you press the 'DEFAULT' button on the Dealer Service Tool (DST or RC7150) while the set is in the normal operation mode.
- When you shorten for a moment (*) the two solder pads on the 'external part' of the SSB print (see Figure 7 in Chapter 4), with the indication SDM (item 4006). Activation can be performed in all modes, except when the set has a problem with the main-processor.
- Via ComPair.

*** Caution:** If the SDM is entered via the pins, all the software-controlled protections are de-activated.
After entering SDM, the following screen will be shown, with 'Service Default' at the lower right side for recognition.



CL 16532044_031.eps
140501

Figure 5-1

How to navigate
When you press the 'MENU' button on the RC transmitter, the set will toggle between the SDM and the normal user menu (with the SDM mode still active in the background).

How to exit SDM
Use one of the following methods:
- Switch the set to STANDBY (⏻) via the RC-transmitter, or
- Press the 'EXIT' button on the DST.

5.2.2 Service Alignment Mode (SAM)

Purpose
- To perform alignments.
- To change option settings.
- To display/clear the error code buffer.

Specifications
- Operation hours counter.
- Software version.
- Option settings.
- Error buffer reading and erasing.
- Software alignments.

How to enter SAM
Use one of the following methods:
- Via a standard RC transmitter: key in the code '062596' directly followed by the OSD [i+] button, or
- When you press the ALIGN button on the DST while the set is in the normal operation mode, or
- When you shorten for a moment (*) the two solder pads on the 'external part' of the SSB print (see Figure 7 in Chapter 4), with the indication SAM (item 4005). Activation can be performed in all modes, except when the set has a problem with the main-processor.
- Via ComPair.

*** Caution:** If the SAM is entered via the pins, all the software controlled protections are de-activated.
The following screen will be shown, with SAM at the upper right side for recognition.

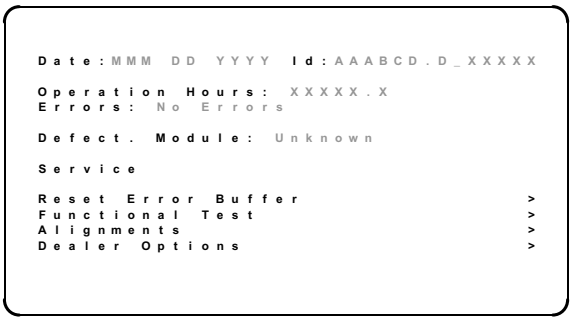


Figure 5-2

- **Date** Displays the software date.
- **ID** Displays the software version of the ROM. Example: EM3E11.0_01234 (AAABCD.D_XXXXX)
  - A = the chassis name (EM3).
  - B = the region: E = Europe, A = Asia Pacific, U = NAFTA, L = LATAM.
  - C = the language cluster number.
  - D = the main software version number.
  - X = latest 5 digits of 12nc code software.
- **SAM** Indication of the actual mode.
- **Operation Hours** Displays the accumulated total of operation hours (not the standby hours).
- **Errors** (followed by maximal 10 errors) The most recent error is displayed at the upper left (for an error explanation see paragraph 5.5.4).
- **Defect. Module** Here the module that generates the error is displayed. If there are multiple errors in the buffer that have not all been generated by a single module, there is probably another defect. It will then display the message 'Unknown' here.
- **Reset Error Buffer** When you press the 'OK' button, the error buffer is reset.
- **Functional Test** All devices are tested via the 'OK' button. Eventual errors are displayed in the error buffer. The error buffer is not erased, the content returns when this test is terminated.
- **Alignments** This will activate the Alignments sub-menu.
- **Dealer Options** Extra features for the dealers.
- **Errors** (followed by maximal 10 errors) The most recent error is displayed at the upper left (for an error explanation see paragraph 5.5.4).
- **Defect. Module** Here the module that generates the error is displayed. If there are multiple errors in the buffer that have not all been generated by a single module, there is probably another defect. It will then display the message 'Unknown' here.
- **Reset Error Buffer** When you press the 'OK' button, the error buffer is reset.
- **Functional Test** All devices are tested via the 'OK' button. Eventual errors are displayed in the error buffer. The error buffer is not erased, the content returns when this test is terminated.
- **Alignments** This will activate the Alignments sub-menu.
- **Dealer Options** Extra features for the dealers.

How to navigate

- In SAM, you can select the menu items with the CURSOR UP/DOWN key on the RC-transmitter. The selected item will be highlighted. When not all menu items fit on the screen, move the CURSOR UP/DOWN key to display the next/previous menu items.
- With the CURSOR LEFT/RIGHT keys, it is possible to:
  - (De)activate the selected menu item.
  - Change the value of the selected menu item.
  - Activate the selected submenu.
- When you press the MENU button twice, the set will switch to the normal user menus (with the SAM mode still active in the background). To return to the SAM-menu press the 'OSD [i+]' button.
- When you press the 'MENU' key in a submenu, you will return to the previous menu.

How to exit SAM

Use one of the following methods:

- Press the 'MENU' button on the RC-transmitter, or
- Switch the set to STANDBY (⏻) via the RC-transmitter, or
- Press the 'EXIT' button on the DST.

5.2.3 Customer Service Mode (CSM)

Purpose

When a customer is having problems with his TV-set, he can call his dealer. The service technician can than ask the customer to activate the CSM, in order to identify the status of the set. Now, the service technician can judge the severness of the complaint. In a lot of cases he can advise the customer how to solve the problem, or he can decide if it is necessary to visit the customer.
The CSM is a read only mode, therefore modifications in this mode are not possible.

How to enter CSM

Use one of the following methods:

- Press the 'MUTE' button on the RC-transmitter **simultaneously** with the 'MENU' button on the TV (top control) for, at least 4 seconds.
- Key in the code '123654' via the standard RC transmitter.

Note 1: Activation of the CSM is only possible if there is no (user) menu on the screen !
Note 2: If you do not point the RC-transmitter correctly to the RC-receiver in the set, and you push the 'MENU' button for more than 6 s, the TV starts in 'demo' mode. To leave this mode, push 'MENU' again for more than 6 s.

After activation of the Customer Service Menu, the following screen (Customer Service Menu 0) will appear:

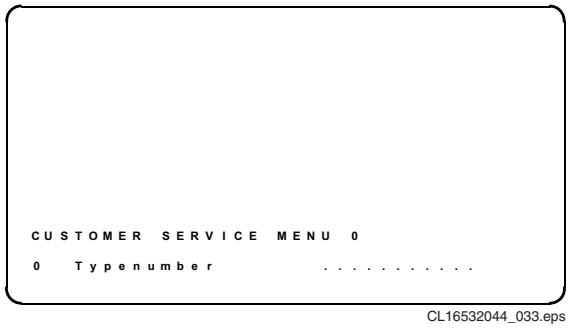
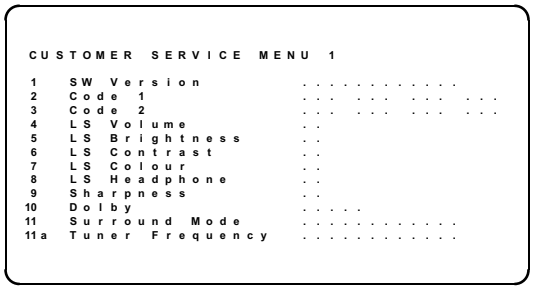


Figure 5-3

- Line 0 - **Type number** (e.g. 28PW8807/12) This information is very helpful for a helpdesk/workshop as reference for further diagnosis. In this way, it is not necessary for the customer to look at the rear of his TV-set.

By means of the 'CURSOR-DOWN' knob on the RC-transmitter the Customer Service Menu 1 will appear. By means of the 'CURSOR-UP' knob on the RC-transmitter the Customer Service Menu 0 will appear again.

Customer Service Menu 1 represents following information:


CUSTOMER SERVICE MENU 1
1 SW Version . . . . . .
2 Code 1 . . . . . .
3 Code 2 . . . . . .
4 LS Volume . .
5 LS Brightness . .
6 LS Contrast . .
7 LS Colour . .
8 LS Headphone . .
9 Sharpness . .
10 Dolby . . . . .
11 Surround Mode . . . . . .
11a Tuner Frequency . . . . . .

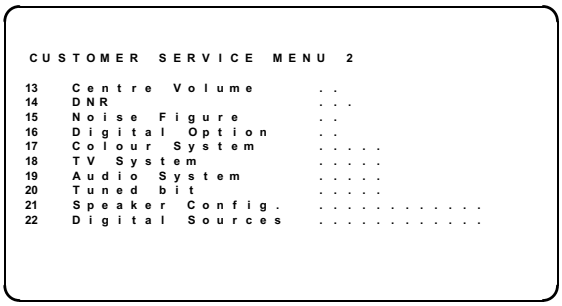
CL16532044_034.eps
140501

Figure 5-4

- Line 1 - **Software version** (e.g. EM3E11.0_XXXXX) The build in software version. You will find details of the software versions in the chapter 'Software Survey' of the 'Product Survey - Colour Television' publication. This publication is generated four times a year.
- Line 2 - **Code 1** Gives the last 5 errors of the error buffer. As soon as the built-in diagnose software has detected an error the buffer is adapted. See paragraph 5.5.4 for a description.
- Line 3 - **Code 2** Gives the first 5 errors of the error buffer. As soon as the built-in diagnose software has detected an error the buffer is adapted. The last occurred error is displayed on the leftmost position of code 2. Each error code is displayed as a 3 digit number. When less than 10 errors occur, the rest of the line(s) is (are) empty. In case of no errors the text 'No Errors' is displayed. See paragraph 5.5.4 for a description.
- Line 4 - **LS Volume** Gives the Last Status of the volume as set by the customer for this selected transmitter. The value can vary from 0 (volume is minimum) to 36 (volume is maximum). Volume values can be changed via the volume key on the RC-transmitter.
- Line 5 - **LS Brightness** Gives the Last Status of the brightness as set by the customer for this selected transmitter. The value can vary from 0 (brightness is minimum) to 63 (brightness is maximum). Brightness values can be changed via the 'CURSOR LEFT' and 'CURSOR RIGHT' keys on the RC-transmitter after pressing the 'MENU' button and selecting 'PICTURE' and 'BRIGHTNESS'.
- Line 6 - **LS Contrast** Gives the Last Status of the contrast as set by the customer. The value can vary from 0 (contrast is minimum) to 63 (contrast is maximum). Contrast values can be changed via 'CURSOR LEFT' and 'CURSOR RIGHT' keys on the RC-transmitter after pressing the 'MENU' button and selecting 'PICTURE' and 'CONTRAST'.
- Line 7 - **LS Colour** Gives the Last Status of the colour saturation, as set by the customer. The value can vary from 0 (colour is minimum) to 63 (colour is maximum). Colour values can be changed via 'CURSOR LEFT' and 'CURSOR RIGHT' keys on the RC-transmitter after pressing the 'MENU' button and selecting 'PICTURE' and 'COLOUR'.
- Line 8 - **LS Headphone** Gives the Last Status of the headphone volume, as set by the customer. The value can vary from 0 (volume is minimum) to 24 (volume is maximum). Headphone volume values can be changed via the 'CURSOR LEFT' and 'CURSOR RIGHT' keys on the RC-transmitter after pressing the 'MENU' button and selecting 'SOUND' and 'HEADPHONE'.
- Line 9 - **Sharpness** Gives the sharpness value. The value can vary from 0 (sharpness is minimum) to 7 (sharpness is maximum). In case of bad antenna signals a too high value of the sharpness can result in a noisy picture. Sharpness values can be changed via the 'CURSOR LEFT' and 'CURSOR RIGHT' keys on the RC-transmitter after pressing the 'MENU' button and selecting 'PICTURE' and 'SHARPNESS'.
- Line 10 - **Dolby** Indicates whether the received transmitter transmits Dolby sound (present) or not (not present). Attention: The presence of Dolby can only be tested by the software on the Dolby Signalling bit. If a Dolby transmission is therefore received without a Dolby Signalling bit, then this indicator will show 'not present' even though such a Dolby transmission is received.
- Line 11 - **Surround Mode** Indicates the by the customer selected surround mode (or automatically chosen mode). In case the set is a Non-Dolby set there will be displayed '0'. If it is a Dolby-set then is displayed: 'Stereo', 3D Surround', 'Dolby Pro Logic', 'Dolby 3 Stereo' or 'Hall'. These settings can be influenced by toggling the surround mode button on remote control (white button). It can also have been selected automatically by signalling bits (internal software
- Line 11a - **Tuner Frequency** Indicates the frequency the selected transmitter is tuned to. The tuner frequency can be changed via the 'CURSOR LEFT' and 'CURSOR RIGHT' keys for fine tune or by entering directly with the digit keys 0 to 9 on the RC-transmitter after opening the installation menu and selecting 'MANUAL INSTALLATION'. The installation menu can be opened by pressing 'TIMER' and 'ENLARGE' at the same time.

By means of the 'CURSOR-DOWN' knob on the RC-transmitter the Customer Service Menu 2 will appear. By means of the 'CURSOR-UP' knob on the RC-transmitter the Customer Service Menu 1 will appear again.

Customer Service Menu 2 represents following information:


CUSTOMER SERVICE MENU 2
13 Centre Volume . .
14 DNR . . .
15 Noise Figure . .
16 Digital Option . .
17 Colour System . . . . .
18 TV System . . . . .
19 Audio System . . . . .
20 Tuned bit . . . . .
21 Speaker Config. . . . . .
22 Digital Sources . . . . . .

CL16532044_035.eps
140501

Figure 5-5

- Line 13 - **Centre Volume** Not valid in this chassis. Must be 0.
- Line 14 - **DNR** Not valid.
- Line 15 - **Noise Figure** Gives the noise ratio for the selected transmitter. This value can vary from 0 (good signal) to 127 (average signal) and to 255 (bad signal).
- Line 16 - **Digital Option** Gives the selected digital mode, '100 HZ', 'DIGITAL SCAN', 'NATURAL MOTION' or 'DOUBLE LINES'. Change via the 'CURSOR LEFT' and 'CURSOR RIGHT' keys on the RC-transmitter, after pressing the 'MENU' button and selecting 'PICTURE', 'DIGITAL OPTIONS'.
- Line 17 - **Colour System** Gives information about the colour system of the selected transmitter.
  - Black and white: No colour carrier received
  - PAL: PAL signal received
  - SECAM: SECAM signal received
  - NTSC: NTSC signal received
- Line 18 - **TV System** Gives information about the video system of the selected transmitter.
  - BG: BG signal received
  - DK: DK signal received
  - I: PAL I signal received
  - L: SECAM L signals received

  - M38.9: NTSC M signal received with video carrier on 38.9 MHz
- Line 19 - **Audio System** Gives information about the audio system of the selected transmitter.
  - Sound Muted: No sound
  - Dolby Pro Logic: Dolby Pro Logic sound received
  - Mono: Mono sound received
  - Stereo: Stereo sound received
  - Dual I: Language I received
  - Dual II: Language II received
  - Digital Mono: Digital mono sound is received
  - Digital Stereo: Digital stereo sound is received
  - Digital Dual I: Digital language I is received
  - Digital Dual II: Digital language II is received
- Line 20 - **Tuned bit** Gives information about the tuning method of the stored pre-set. If a channel is found via 'automatic installation' you will see the value 'Off'. When you change this (automatically found) frequency via 'fine tune' adjustment (installation menu - manual installation), the displayed value will change to 'On'. So when you see the value 'On' in this line, it is an indication that the received channel is a non-standard signal (e.g. of a VCR).
- Line 21 - **Speaker config.** Gives the speaker configuration settings. In case the set is a non-Dolby set, it displays '0'. If it is a Dolby-set, it displays: 'FULL INTERNAL', 'L/R EXTERNAL', 'SURROUND EXTERNAL' or 'FULL EXTERNAL'. Change the speaker configuration (for a Dolby-set), via the 'CURSOR LEFT' and 'CURSOR RIGHT' keys on the RC-handset after opening the 'INSTALLATION' menu and selecting 'SETUP'. Open the 'INSTALLATION' menu by pressing the 'TIMER' and 'ENLARGE' buttons at the same time.
- Line 22 - **Digital Sources** Gives the configuration setting for the digital source. It displays: 'FRONT', 'EXT1', 'EXT2', 'EXT3' or 'NONE'. If one of these is selected, the starting point is a top quality signal on that input and a number of settings are therefore changed automatically. Change the digital source via the 'CURSOR LEFT' and 'CURSOR RIGHT' keys on the RC-transmitter after opening the installation menu and selecting 'SETUP'. The installation menu can be opened by pressing 'TIMER' and 'ENLARGE' at the same time.

How to exit CSM
Use one of the following methods:
- After you press a key on the RC-transmitter (with exception of the 'CHANNEL' and 'VOLUME' keys), or
- After you switch the TV-set 'OFF' with the mains switch.

5.3 Problems and Solving Tips (related to CSM)

Note: Below described problems are all related to the TV settings. The procedures to change the value (or status) of the different settings, are described above.
The new value(s) are automatically stored.

5.3.1 Picture Problems

Worse picture quality in case of DVD pictures
Check line 22 'Digital sources'. In case line 22 gives the indication 'Not Present', change the setting into 'Present' (via the 'installation' menu).

Snowy/noisy picture
1. Check line 15 'Noise Figure'. In case the value is 127 or higher and the value is also high on other programs, check the aerial cable/aerial system.
2. Check lines 9 'Sharpness' and 15 'Noise Figure'. In case the value of line 9 is 3 or 4 and the value of line 15 is high (127 or higher), decrease the 'Sharpness' value.

Picture too dark
1. Press 'Smart Picture' button on the RC-transmitter. In case the picture improves, increase the 'Brightness' or the 'Contrast' value. The new value(s) are automatically stored (in 'personal' pre-set) for all TV channels.
2. Check lines 5 'LS Brightness' and 6 'LS Contrast'. If the value of line 5 is low (< 10) or the value of line 6 is low (< 10), increase the 'Brightness' or the 'Contrast' value.

Picture too bright
1. Press 'Smart Picture' button on the RC-transmitter. In case the picture improves, decrease the 'Brightness' or the 'Contrast' value. The new value(s) are automatically stored (in 'personal' pre-set) for all TV channels.
2. Check lines 5 'LS Brightness' and 6 'LS Contrast'. If the value of line 5 is high (> 40) or the value of line 6 is high (< 50). Decrease the 'Brightness' value or increase the 'Contrast' value.

White line around picture elements and text
1. Press 'Smart Picture' button on the Remote Control. In case the picture improves, decrease the 'Sharpness' value. The new value is automatically stored (in 'personal' pre-set) for all TV channels.
2. Check line 9 'Sharpness'. Decrease the 'Sharpness' value. The new value is automatically stored for all TV channels.

No picture
Check line 20 'Tuned bit'. In case the value is 'On', install the required program again. Open the installation menu by pressing 'timer' and 'enlarge' at the same time and perform manual installation.

Blue picture
No proper signal is received. Check the aerial cable/aerial system.

Blue picture and/or unstable picture
A scrambled or decoded signal is received.

Black and white picture
Check line 7 'LS Colour'. In case the value is low (< 10) increase the 'Colour' value. The new value is automatically stored for all TV channels.

No colours/colour lines around picture elements
1. Check lines 17 'Colour System' and 18 'TV System'. If a 'strange' system pop's up, something has gone wrong during installation. Re-install the channel.
2. In case line 17 is 'PAL' and line 18 is 'L', the installed system for this pre-set is 'France', while 'West Europe' is required. Install the required program again: open the installation menu by pressing 'timer' and 'enlarge' at the same time and perform manual installation. Select system 'West Europe'.

Colours not correct
Check lines 17 'Colour System' and 18 'TV System'. In case line 17 is 'PAL' and line 18 is 'L', the installed system for this pre-set is 'France', while 'West Europe' is required. Install the required program again: open the installation menu by pressing 'timer' and 'enlarge' at the same time and perform manual installation. Select 'System; West Europe'.

Colours not correct/unstable picture
Check lines 17 'Colour System' and 18 'TV System'. In case line 17 is 'SECAM' and line 18 is 'BG', the installed system for this pre-set is 'West Europe', while 'France' is required. Install the required program again: open the installation menu by pressing 'timer' and 'enlarge' at the same time and perform manual installation. Select 'System; France'.

Unstable picture
Check lines 17 'Colour System' and 18 'TV System'. In case line 17 is 'SECAM' and line 18 is 'M 38,9', the installed system for this pre-set is 'West Europe', while 'France' is required. Install the required program again: open the installation menu by pressing 'timer' and 'enlarge' at the same time and perform manual installation. Select 'System; France'.

Menu text not sharp enough
1. Press 'Smart Picture' button on the RC-transmitter. In case picture improves, Decrease the contrast value. The new value(s) are automatically stored for all TV channels.
2. Check line 7 'LS Contrast'. The value of line 7 is high (> 50). Decrease the contrast value.

5.3.2 Sound Problems

No sound from left and right speaker
1. Check line 4 'LS Volume'. The value is low. Increase the value of 'Volume'. The new value(s) are automatically stored (in 'personal' pre-set) for all TV channels.

Sound too loud for left and right speaker
1. Check line 4 'LS Volume'. The value is high. Decrease the value of 'LS Volume'. The new value(s) are automatically stored (in 'personal' pre-set) for all TV channels.

5.4 ComPair

5.4.1 Introduction

ComPair (Computer Aided Repair) is a service tool for Philips Consumer Electronics products. ComPair is a further development on the European DST (service remote control), which allows faster and more accurate diagnostics. ComPair has three big advantages:
- ComPair helps you to quickly get an understanding on how to repair the chassis in a short time by guiding you systematically through the repair procedures.
- ComPair allows very detailed diagnostics (on I^2C level) and is therefore capable of accurately indicating problem areas. You do not have to know anything about I^2C commands yourself because ComPair takes care of this.
- ComPair speeds up the repair time since it can automatically communicate with the chassis (when the microprocessor is working) and all repair information is directly available. When ComPair is installed together with the SearchMan electronic manual of the defective chassis, schematics and PWBs are only a mouse click away.

5.4.2 Specifications

ComPair consists of a Windows based faultfinding program and an interface box between PC and the (defective) product. The ComPair interface box is connected to the PC via a serial or RS232 cable.
In case of the EM3E chassis, the ComPair interface box and the TV communicate via a bi-directional service cable via the service connector.

The ComPair faultfinding program is able to determine the problem of the defective television. ComPair can gather diagnostic information in two ways:
- Automatic (by communication with the television): ComPair can automatically read out the contents of the entire error buffer. Diagnosis is done on I^2C level. ComPair can access the I^2C bus of the television. ComPair can send and receive I^2C commands to the micro controller of the television. In this way, it is possible for ComPair to communicate (read and write) to devices on the I^2C busses of the TV-set.
- Manually (by asking questions to you): Automatic diagnosis is only possible if the micro controller of the television is working correctly and only to a certain extends. When this is not the case, ComPair will guide you through the faultfinding tree by asking you questions (e.g. *Does the screen give a picture? Click on the correct answer: YES / NO*) and showing you examples (e.g. *Measure test-point I7 and click on the correct oscillogram you see on the oscilloscope*). You can answer by clicking on a link (e.g. text or a waveform picture) that will bring you to the next step in the faultfinding process.

By a combination of automatic diagnostics and an interactive question / answer procedure, ComPair will enable you to find most problems in a fast and effective way.

Beside fault finding, ComPair provides some **additional features** like:
- Up- or downloading of pre-sets.
- Managing of pre-set lists.
- Emulation of the Dealer Service Tool (DST).
- If both ComPair and SearchMan (Electronic Service Manual) are installed, all the schematics and the PWBs of the set are available by clicking on the appropriate hyperlink.
  Example: *Measure the DC-voltage on capacitor C2568 (Schematic/Panel) at the Monocarrier. Click on the 'Panel' hyperlink to automatically show the PWB with a highlighted capacitor C2568. Click on the 'Schematic' hyperlink to automatically show the position of the highlighted capacitor.*

5.4.3 Stepwise Start Up / Shut Down

Under normal circumstances, a fault in the power supply, or an error during start-up, will switch the television to protection mode. ComPair can take over the initialisation of the television. In this way it is possible to distinguish which part of the start-up routine (hence which circuitry) is causing the problem.

Stepwise start up explanation
This is realised via ComPair and is very helpful when a **protection** is activated (see also chapter 5.7).

State	Description mode	Display LED (Red)	Enabled protection
0	Low power stdby: 5V2/3V3 present, uP in stdby-mode	On	None
1	High power Stdby: TV-set in stdby-mode	Wait 1s, flash 1 x	None
2	SSB is powered by stdby-supply (5V/8V). Degaussing (12 s) has been activated.	Wait 1s, flash 2 x	4 & 5
3	Semi stdby-mode: HIP, HOP, MSP and Tuner initialized leading to semi stdby-mode.	Wait 1s, flash 3 x	Plus 1, 6 & 18
4	All ICs are initialized, HOP activates the main supply, EHT-generation starts, black current stabilization is on	Wait 1s, flash 4 x	Plus 2 & 16
5	TV On: TV-set operates, un-blanked picture.	Wait 1s, flash 5 x	

CL 16432044_036.eps
140501

Figure 5-6

Stepwise shut down explanation
In the stepwise shutdown mode, state 2 is skipped (it is not possible to de-initialise ICs).

State	Description mode	Display LED (Red)	Disabled protections
5	TV On: TV-set operates, un-blanked picture	Wait 1s, flash 5 x	-
3	Semi stdby-mode: SSB is powered by the stdby-supply	Wait 1s, flash 3 x	18, 16, 6, 2 & 1
1	High power stdby: TV-set in stdby-mode	Wait 1s, flash 1 x	4 & 5
0	Low power stdby: 5V2/3V3 present, uP in stdbymode	On	

CL 16432044_037.eps
140501

Figure 5-7

Note: When the set is in stepwise mode and, due to stepping-up, a protection is activated, the set will really go into protection (blinking red LED). The set will not leave the stepwise-mode however. By stepping up, the set can be activated again, until state X where the protection was activated. At state (X-1) diagnostic measurements can be performed.

5.4.4 How To Connect

1. First install the ComPair Browser software (see the Quick Reference Card for installation instructions).
2. Connect the RS232 interface cable between a free serial (COM) port of your PC and the PC connector (marked with 'PC') of the ComPair interface.
3. Connect the mains adapter to the supply connector (marked with 'POWER 9V DC') of the ComPair interface.
4. Switch the ComPair interface 'OFF'.
5. Switch the television set 'OFF' with the mains switch.
6. Connect the ComPair interface cable between the connector on the rear side of the ComPair interface (marked with 'I^2C') and the ComPair connector at the rear side of the TV (situated just below the tuner input, see also chapter 4).
7. Plug the mains adapter in a mains outlet, and switch the interface 'ON'. The green and red LEDs light up together. The red LED extinguishes after approx. 1 second while the green LED remains lit.
8. Start the ComPair program and read the 'Introduction' chapter.

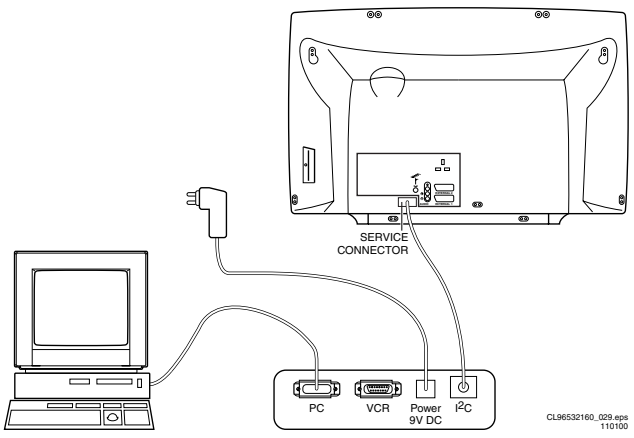


Figure 5-8

5.4.5 How To Order

ComPair order codes:
- Starter kit ComPair + SearchMan software + ComPair interface (excluding transformer): 4822 727 21629
- ComPair interface (excluding transformer): 4822 727 21631
- Starter kit ComPair software (registration version): 4822 727 21634
- Starter kit SearchMan software: 4822 727 21635
- ComPair CD (update): 4822 727 21637
- SearchMan CD (update): 4822 727 21638
- ComPair interface cable: 3122 785 90004

5.5 Error Buffer

5.5.1 Introduction

The error code buffer contains all detected errors since the last time the buffer was erased. The buffer is written from left to right. When an error occurs that is not yet in the error code buffer, it is written at the left side and all other errors shift one position to the right.

5.5.2 How to Read the Error Buffer

Use one of the following methods:
- On screen via the SAM (only if you have a picture). Examples:
  - ERROR: 0 0 0 0 0 : No errors detected
  - ERROR: 6 0 0 0 0 : Error code 6 is the last and only detected error
  - ERROR: 9 6 0 0 0 : Error code 6 was first detected and error code 9 is the last detected (newest) error
- Via the blinking LED procedure (when you have no picture). See next paragraph.
- Via ComPair.

5.5.3 How to Clear the Error Buffer

Use one of the following methods:
- By activation of the 'RESET ERROR BUFFER' command in the SAM menu:
- When you transmit the commands 'DIAGNOSE' - '99' - 'OK' with ComPair (or with a DST).
- If the content of the error buffer has not changed for 50 hours, it resets automatically.

5.5.4 Error Codes

In case of non-intermittent faults, clear the error buffer before you begin the repair. These to ensure that old error codes are no longer present.

If possible, check the entire contents of the error buffer. In some situations an error code is only the result of another error code and not the actual cause (e.g., a fault in the protection detection circuitry can also lead to a protection).

Error	Device	Description	Defective item	Diagram	Defect. module indication
1	ST24E32	NVM, spontaneous blinking 1-1-1..	7011	B5	Control
2	H fail protection	HFB			Horizontal Flyback Or HW-protection due to: - ARC_PROT - BRIDGE_PROT - NON_VFB PROT
3	SAA4978	PICNIC	7709	B3	Feature Box
4	Supply 5 V	5V2 protection		B5	+5 V Supply
5	Supply 8 V	8V6 protection		B5	+8 V Supply
6	Slow I^2C-bus blocked	Slow I^2C-bus blocked, spontaneous blinking 6-6-6..			Slow I^2C blocked
7	TDA9330	HOP video control/geometry	7301	B4	Video Controller
8	TDA9320	HIP I/O video processing	7323	B2	Chroma IF IO
9	PCF8574	Wireless expander			
10	Reserved				
11	Reserved				
12	TDA9178	LTP Peaking			Video Controller
13	UV1316/TEDE9	Tuner	U1200	A8	Tuner
14	MSP34xx	Sound processor + Dolby	7651	B6	Audio Module
15	Reserved				
16	Featurebox protection	Featurebox protection		B3	+3 V (FBX) supply
17	Reserved				
18	Fast I^2C-bus blocked	Fast I^2C-bus blocked, spontaneous blinking 18-18-18..			Fast I^2C blocked

CL 16432044_038.eps
280501

Figure 5-9

Note: Error codes 1, 6 or 18 are protection codes and in this case, supplies of some circuits will be switched off. Also in protection, the LED will blink the number of times equivalent to the most recent error code.

5.6 The Blinking LED Procedure

5.6.1 Introduction

Via this procedure, you can make the contents of the error buffer visible via the front LED. This is especially useful for fault finding, when there is no picture.

When the SDM is entered, the front LED will show (blink) the contents of the error-buffer. Error-codes ≥ 10 are shown as follows:
- a long blink of 750 ms (which is an indication of the decimal digit),
- a pause of 1.5 s,
- n short blinks (where n = 1 - 9),
- when all the error-codes are displayed, the sequence finishes with a LED blink of 3 s,
- the sequence starts again.

Example: Error **12 9 6 0 0**.
After activation of the SDM, the red front LED will show:
- 1 long blink of 750 ms (which is an indication of the decimal digit) followed by a pause of 1.5 s,
- 2 short blinks followed by a pause of 3 s,
- 9 short blinks followed by a pause of 3 s,
- 6 short blinks followed by a pause of 3 s,
- 1 long blink of 3 s to finish the sequence,
- the sequence starts again.

Note 1: If errors 1, 6 or 18 occur, the LED ***always*** gives the last occurred error even if the set is NOT in service mode.
Note 2: If on the DST the text 'ERROR 2' is displayed, the communication from the TV to the DST has failed.

5.6.2 How to Enter

Use one of the following methods:
- Enter the SDM. The blinking red front LED will show the contents of the error buffer (this works only in 'normal operation' mode).
- Transmit the commands 'DIAGNOSE' - '0' - 'OK' with a DST/ComPair (this works both in 'Standby mode' and 'protection' mode). The complete error buffer is shown.
- Via the 'DIAGNOSE' - 'X' - 'OK' function on the DST/ ComPair (where X is a number between 1 and 5):
  1. Press the 'DIAGNOSE' button on the DST (possible in all modes except SAM).
  2. Press '1' to view the last detected error (or '2', etc. to show the errors before).
  3. Press the 'OK' button. The red front LED will now give the requested error.

5.7 Protections

5.7.1 Introduction

The EM3E has only one micro-processor (OTC), which remains active during Standby. This because power of the microprocessor and the attached memory chip set is coming from the 3V3 supply, which is derived from the 5V Standby-circuitry (via stabiliser 7005). So in both Power-on as in Standby mode the microprocessor is connected to this power supply.

If a fault situation is detected, an error code will be generated and if necessary, the set is put in protection mode. The protection mode is indicated by the blinking of the red front LED at a frequency of 3 Hz (or by a coded blinking in special cases). In some error cases however, the micro processor does not put the set in the protection mode (this is the case with the - hardware - loudspeaker protection of the audio amplifier).

The content of the error buffer can be read via the service menu (SAM), the blinking LED procedure or via DST/ ComPair.
The DST/ComPair 'diagnose' functionality will force the set into the 'Service Standby', which is alike the usual Standby, however the microprocessor remains completely in normal operation.

To get a quick diagnosis the EM3E has 3 service-modes implemented:
- The Customer Service Mode (CSM).
- The Service Default Mode (SDM). Start-up of the set in a predefined way.
- The Service Alignment Mode (SAM). In this mode items of the set can be adjusted via a menu and with the help of test patterns.

Both SDM & SAM modes can be entered via the 'service pads' on the SSB (see Figure 4-7), via an RC-transmitter (DST or standard RC) or via ComPair. It is not possible to enter the SAM in Standby, the set has to be in 'normal operation' mode.

The EM3E 'Protection Diagram' shows the structure of the protection system. See diagram below.

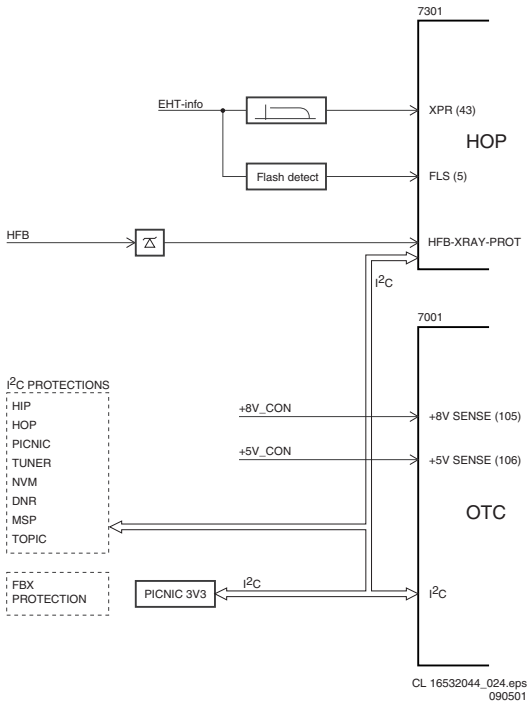


Figure 5-10

There are several types of protections:
- I^2C related protections.
- OTC related protections (via polling on I/O pins or via algorithms).
- HOP related protections (mainly for deflection items).
- Hardware errors that are not sensed by the OTC (e.g. BRIDGECOIL_PROT, NON_VFB, ARC_PROT).

All protections are explained below.

5.7.2 I^2C Related Protections

In normal operation, some registers of the I^2C controlled ICs are refreshed every 200 ms. During this sequence, the I^2C busses and the I^2C ICs are checked.
An I^2C protection will take place if the SDA and SCL lines are short-circuited to ground, or to each other. An I^2C error will also occur, if the power supply of the IC is missing (e.g. FBX_PROT (error 16)).

5.7.3 OTC Related Protections

If a protection is detected at an OTC input, the OTC will start to scan all protection inputs every 200 ms for 5 times. If the protection on one of the inputs is still active after 1 s, the µP will put the set in the protection mode. Before the scanning is started, a so called 'ESD refresh' is carried out. This is done, because the interrupt on one of the inputs is possibly caused either by a flash or by ESD. As a flash or ESD can influence IC settings, the HOP, HIP, MSP, PICNIC, NVM and Tuner are initialised again, to ensure the normal picture and sound conditions of the set.

8 V and 5 V protection: The µP senses the presence of the 8 V and 5 V (via the '+5V_CON' and '+8V_CON' lines). If one (or both) of these voltages is (are) not present, an error code is stored in the error buffer of the NVM, and the set is put in the protection mode.

5.7.4 HOP Related Protections

Every 200 ms, the status register of the HOP is read by the OTC (via the I^2C bus). If a protection signal is detected on one of the inputs of the HOP, the relevant error bit in the HOP register is set to 'high'. If this error bit is still 'high' after 1 s, the OTC will store the error code in the error buffer of the NVM and, depending on the relevancy of the error bit, the set will either go into the protection mode or not.

The following protections are implemented:
- **HFB (Horizontal Flyback):** If the horizontal flyback is not present, this is detected via the HOP (HFB_X-RAY_PROT). One status bit is set to 'high'. The error code is stored in the error buffer and the set will go into the protection mode.
- **Flash detection:** When a flash is detected via the EHT-info line (via D6303 and T7303), the H-drive (and so the Line output stage) is stopped immediately. The FLS-bit in the HOP status register is set to 'high'. As the duration of a flash is very short, the FLS-bit is re-set to 'low' again after the flash refresh, and via a 'slow start' the set will start again.

5.7.5 Hardware Related Protections

Due to the architecture (with 'hot' deflection) there are some protections that can not be sensed by the microprocessor. Three of these protections will lead to a protection on set level (Standby mode and blinking LED), while another will only lead to a circuit protection.

TV-set Protection
The following fault conditions will lead to a 'complete' set protection:
- **BRIDGECOIL protection:** This is sensed via the 'EW' signal going to the base of TS7652 (via R3495 and D6499). In a normal situation, the voltage on C2498 (diagram A4) is high, TS7652 is conducting. When bridge coil 5422 (diagram A3) is short circuited, the voltage on C2498 changes to low, which will block TS7652. In this case, also TS7641 will block and the voltage on 2642 will rise until TS7443 is forced in conduction. The 'SUP-ENABLE' signal (in normal operating condition -20 V) is shorted now to ground level, which will force the Main Power Supply to Standby mode.
- **ARC protection:** If there are 'open' connections (e.g. bad solder joints) in the *high energy* deflection circuitry, this can lead to damaging effects (read: fire). For that reason, the E/W current is sensed (via 3479//3480). If this current becomes too high, the 'thyristor' circuit (TS7653 and TS7654) is triggered. TS7442 is switched 'on' and TS7443 is forced into conduction. . The 'SUP-ENABLE' signal is shorted now to ground level, which will force the Main Power Supply to Standby mode.

- **NON_VFB (No vertical Flyback) protection.** If the frame stage generates no pulses, TS7641 will block. TS7443 is now switched 'on', which will lead to Standby mode. So in normal operation condition, TS7641 and TS7652 are conducting, while TS7443 is blocked.

Circuit Protection
The following fault condition will lead to a 'partly' set protection:

- **PROT1 protection:** When a DC-voltage (positive or negative) is sensed on one of the loudspeaker outputs, the protection circuit (TS7704, 7705, 7706 and 7707), will put the IC7700 in Standby mode (via tri-state input pin 6). For more details see chapter 9.

5.8 Repair Tips

5.8.1 Miscellaneous

The relay you hear when you switch the set 'on' (from Standby or via the mains switch), is from the degaussing circuitry. It is not used for switching the Power Supply (as done in the MG-chassis).

Take care not to touch the 'hot' heatsink while disconnecting the SSB, despite the fact that the mains cord is out of the mains socket. There can still be an annoying rest-voltage on the heatsink for a short while. This, because the discharge resistors 3502 and 3503 (on the LSP between hot and cold part) are not stuffed for Europe.
Instead, discharge resistors 3066 and 3057 on the Mains Switch panel are used, but because they are located before the Mains switch, they only discharge when this switch is 'on'.
Advice: when you remove the SSB, disconnect the Mains cord, but keep the Mains switch 'on'.

Do not try to measure on the SSB side, which is facing the 'hot' heatsink. This is dangerous. Most service test points are guided to the 'tuner' side and are indicated by the 'service' printing. Where the circuitry was too 'crowded' for this printing, you can find the correct location on the 'test point overviews' in this manual (chapter 6).

A very large part of the LSP is '**hot**', such as:
– the primary part of the Standby Supply,
– the whole Main supply (except for the secondary Audio supply),
– and the complete deflection circuitry (so notice that the deflection coil is hot !!).

5.8.2 Start-up Sequence

The start up sequence differs from other sets (e.g. MG-sets or EM2E-sets):
1. When the set is switched 'on', the 5 and 8 V lines ('+5V_CON' and '+8V_CON') of the standby power supply are activated.
2. After they are sensed by the OTC, the µP will address the HOP via the I²C-bus, to start the drive [1].
3. Via the 'SUP-ENABLE' signal, the Main Supply is switched 'on' and will deliver the VBAT to the Line deflection stage [2].
4. EHT generation is now started.
5. The OTC will un-blank the picture.
6. When you switch 'off' the set, this is done in a controlled way via the POR signal [3].

Note: Standby is not directly achieved via the Standby line of the microprocessor, but indirectly via the HOP circuitry.

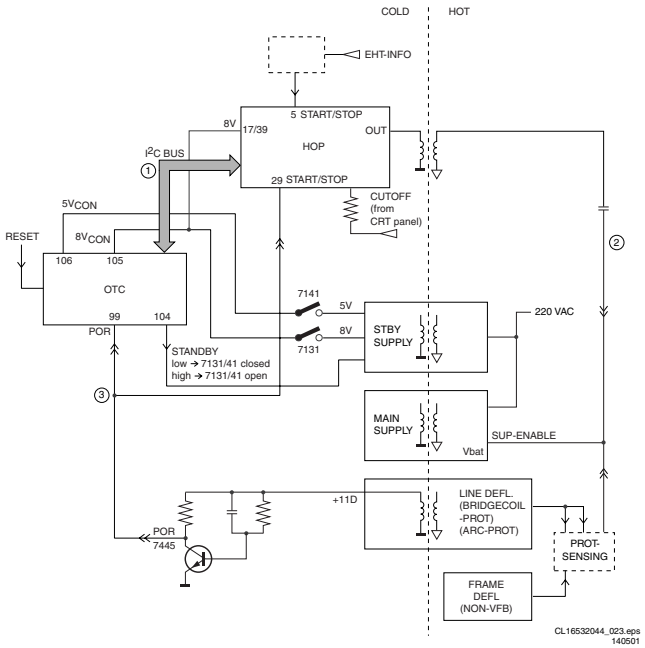


Figure 5-11

5.8.3 ComPair

This chassis does not have an IR transmitting LED (as in MG-sets). Therefore a 'Service' (ComPair) connector is implemented at the rear side of the set, which is directly accessible (as in EM2E-sets). In addition to this, there is also a blinking LED procedure to show the contents of the error buffer.

When you use ComPair, you have the possibility to activate a 'stepwise start-up' mode. With this mode, you can initiate the start-up sequence step by step. This also means that in certain steps, some protections are not activated. This is sometimes very convenient during repair (see also paragraph 5.4.3).

5.8.4 Protections

There are 'service pads' implemented on the SSB (items 4005 and 4006, outside the shielding), to force the set in SDM or SAM (see also Fig. 7 in Chapter 4). This will overrule the processor-controlled protections, but not the hardware protections. This means, that the A/D-input protections (5 and 8 V) and the I²C 'not-acknowledging' info from the feature box (FBX) are overruled. **Caution:** When doing this, the service technician must know what he is doing, as it could lead to damaging the set.

The 'ARC'- and/or 'BRIDGECOIL' protection are hardly ever triggered, however:
– When you suspect the 'ARC' protection, look for bad solderjoints and smell. By interrupting resistor 3497, this protection is disabled (special attention needed !).
– When you suspect the 'BRIDGECOIL' protection, which can also be due to a too wide picture amplitude, shorten G and S of of the E/W MOSFET 7480. This will disable the protection. You will now have a minimal horizontal amplitude. Re-align the horizontal amplitude in the SAM menu and remove the G/S short of TS7480.

5.8.5 Main Supply

- The simplest way is, to replace the components of the Main Supply with repair kit (3122 785 90310)
- More detailed way:

- Replace FET 7504 and zener 6505.
- Remove the SSB panel.
- Short B and E of TS7529, in order to put the Main Supply in 'on'-mode (TS7529 is blocking then). **Caution:** To prevent that this will damage R3403 and TS7443, **first disable the HW-protection of the deflection circuit.** Therefor short circuit C2642 on the LSP (diagram A4)
- Attach a load of 500 Ω to VBAT capacitor C2515 (the supply can not work without a minimum load).
- Use a variac, and slowly increase the VMAINS. Measure over sensing resistors R3514//15 if a nice sawtooth voltage becomes available.
- Also measure the VBAT . This may never exceed +141 V. If it does, there is something wrong in the feedback circuitry (e.g. regulator 7506).

• **Note:** Be careful when measuring on the gate of FET TS7504. This circuitry is very high-ohmic and can easily be damaged (first connect ground to measuring equipment, than measure the gate).

5.8.6 Standby Supply

The simplest way is to replace the components of the Standby Supply with repair kit 3122 785 90320.

5.8.7 Line Deflection

The simplest way is to replace the components of the Line Deflection circuitry with repair kit 3122 785 90330.

5.8.8 Frame Deflection

Caution: When the Frame Deflection circuitry is suspected, one must be careful. Because there is a DC-voltage on the frame deflection, the beam current could damage the CRT neck, leading to a defective CRT.

Best thing to do is:

1. Interrupt the resistors 3403 and 3404 on the CRT panel (diagram F), in order to remove the 'filament' voltage from the tube (no beam current, so no chance of destroying the CRT).
2. Interrupt resistor 3403 on the LSP (diagram A4) to disable the 'SUP-ENABLE' line.
3. Measure with a multimeter, or better with a oscilloscope, the functionality of the Frame stage.
4. After you've found the cause, exchange the defective component (e.g. TDA8177), and re-solder the interrupted resistors.

Phenomenon	Possible Cause	Repair tip
No picture, no LED.	Standby Supply defective.	Measure circuitry (see diagram A2). Start at test-point A19. When the Mains switch is 'on', this voltage must always be available
No picture, no LED.	Bad connection of SSB in SIMM-connector.	In case of a bad connection, it can happen that there is no picture, and that the Standby LED is not controllable. Re-place the SSB.
No picture, red LED blinking at 3 Hz.	Set is in protection due to various causes. For error codes see error-code list.	You have no picture, so: - or you read the error buffer via ComPair - or you read the blinking LED information via 'diagnose'-'x'-'ok' on DST - or you read the error code sequence via 'diagnose'-'0'-'ok' with the DST. When you have found the error, check the circuitry related to the supply voltage and I^2C-communication or the circuitry that triggers the protection.
No picture, red LED blinking with code 6-6-6 or 18-18-18.	No communication on slow I^2C- or fast I^2C-bus.	As processor cannot communicate with one of the 2 busses it the standby-led spontaneously starts blinking 6-6-6… or 18-18-18…. If in the error buffer somewhere is an error 6 or 18, these will have the highest priority starting the mentioned blinking. Measure dependent of the error on the I^2C-bus which device is loading the bus. (use I^2C -overview)
No picture, red LED blinking with code 1-1-1.	No communication on NVM-I^2C bus to the µP.	As the µP cannot communicate with the NVM I^2C bus, it spontaneously starts blinking 1-1-1. Note: when there is no access to the NVM, a lot of picture setting can go wrong.
No picture, no sound. Set is making audible squeaking sound	Supply is possibly in hiccup-mode, which is audible via a squeaking supply transformer.	Possible causes: - V_{BAT} is shorted (caused by short circuited line transistor 7421), or - Sound winding is shorted (amplifier is shortening the power supply lines), or - D6514 is shorted (due to a too high V_{BAT}). Remove excessive load, to see what causes the failure, or check feedback circuit. See repair tip 'Main Power Supply' (supply needs a minimal load).
No picture, no sound. Green LED works fine	Supply does not work correctly.	If e.g. V_{BAT} is only about 90 V, it is possible that the regulator IC (7506) is defective.
No RC-reception. Red LED does not echo RC-commands.	µP circuitry or RC-receiver is defective.	In case the set does react on a local keyboard operation, you must check the RC-receiver circuitry (diagram E).
Relay (degaussing) is not audible, when set is switched from 'off' or 'standby' to 'on'.	µP is not working correctly. When pin 115 is low, the degaussing must be activated.	Check RESET-circuitry on diagram B5. Check the level on pin 115 when you switch the set 'on'. Signal must be low initially and go to high after approx. 12 s.
No sound, only picture.	Measure A7/A8 on diagram A1. Possibly the audio amplifier is defect (but not shorted), or the 'sound enable' line is high (diagram A5). Further, measure the audio signal path (HIP-MSP-Switch ICs-Amplifier).	In ComPair, a beep test can determine where the signal stops (use loudspeakers or headphone). Possible cause is also the 'PROT1' protection (see diagram. A6). This is a loudspeaker DC protection, which the µP can not sense. Via circuitry 7701/7707, this signal can put audio amplifiers 7700 and 7702 in standby mode (tri-state input). Warning: Find out, which amplifier is causing the problem, because it is possible, that the other one is OK.
No sound at headphone output.	HP amplifier (7770), or the supply to it, malfunctions.	Measure test points A64 to A67, and the supply line (+/- 16/19V) on diagram A7.
Picture is rotated.	Rotation circuitry, or related supply to it, malfunctions.	Measure test points A52 and A53 on diagram A5.
Picture is continuously switching 'off' and 'on', showing heavy 'switch' spots (set does not go into protection).	200 V is missing on CRT panel.	Probably a bad connection from LSP connector 1424 to CRT connector 1224 (diagram F), or an interruption of the 200 V supply line (e.g. R3341 is interrupted).
Picture is not sharp.	Focus is possibly mis-aligned or SCAVEM-circuitry does not work correctly.	Re-align the 'focus' potmeter on the Line Output Transformer, or check the SCAVEM circuitry on the CRT-panel (diagram F). It is also possible that the DAF circuitry is defective (see diagram I). Check the Vdc values.
Picture is not synchronised.	The sync is derived in the HIP from xtal 1305 and/or 1308.	Maybe the crystals 1305 and/or 1308 are making a bad contact.
Picture is distorted.	Check video-path in Service Default Mode.	Investigate whether there is an error code present in the error buffer. In case there is one, check the I^2C-bus and/or supply lines (see overview supply lines). Measure and check signal path Tuner-HIP-PICNIC-HOP-RGB amplifier. In case it is a geometry issue, check opto-coupler 7482, OpAmps 7440/7450 and the Frame circuitry alignments or a possible corrupted NVM (7011).
Picture with horizontal stripes.	Feature box processing is malfunctioning	Check functionality of PICNIC (7709), FALCONIC (7726) and/or field memories (7714 and 7740). TS7726 and 7740 are suspected.
No menu, no OSD.	Probably a defective µP.	Measure test points B61to B64 on diagram B5.
No NextView (EPG).	IC7012 defective or not powered.	Check circuitry around IC7012.
No Teletext.	IC7007 defective or not powered.	Check circuitry around IC7007. Check also B61to B64 around µP on diagram B5.
Strange switch 'off' behaviour	TS7445 possibly defective.	Check, with a multimeter, whether transistor TS7445 is well functioning.
Various symptoms, due to missing local supply voltage.	An interrupted fuse, NFR-resistor or connection.	When no symptom or error code leads you to a specific circuitry, use the supply lines overview (see chapter 6), for a quick scan of all supply lines.

CL 16532044_039.eps
140501

Personal Notes:

8. Electrical Alignments

Index of this chapter:
1. General alignment conditions.
2. Hardware alignments.
3. Software alingnments.
4. Option settings.

Note: The Service Default Mode (SDM) and Service Alignment Mode (SAM) are described in chapter 5. Menu navigation is done with the 'CURSOR UP, DOWN, LEFT or RIGHT' keys of the remote control transmitter.

8.1 General Alignment Conditions

Perform all electrical adjustments under the following conditions:
- Power supply voltage: 230 V_{AC} / 50 Hz (± 10 %).
- Connect the set to the mains via an isolation transformer with low internal resistance.
- Allow the set to warm up for approximately 20 minutes.
- Measure the voltages and waveforms in relation to chassis ground (with the exception of the voltages on the primary side of the power supply).
  Caution: never use the cooling fins / plates as ground.
- Test probe: Ri > 10 MΩ, Ci < 20 pF.
- Use an isolated trimmer/screwdriver to perform the alignments.

8.2 Hardware Alignments

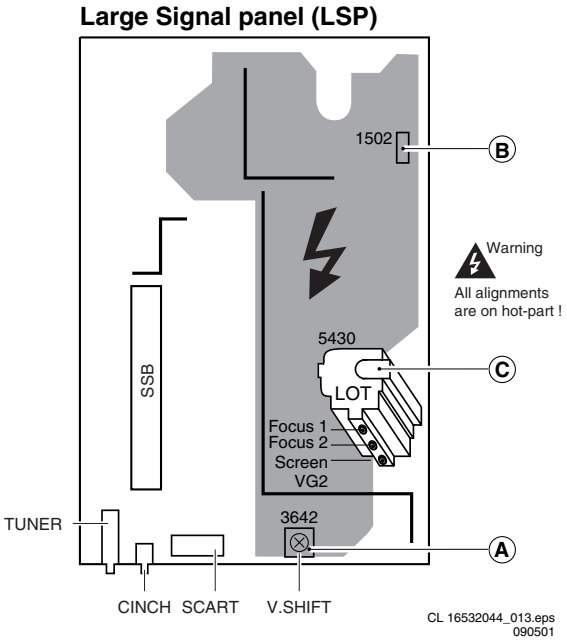


Figure 8-1

8.2.1 Vg2 Adjustment

Method 1 (without oscilloscope)
1. Activate the SAM.
2. Select ‘Alignments’.
3. Select the ‘General’ sub-menu.
4. Set ‘Vg2 Test Pattern’ to ‘On’
5. First turn the Vg2 potmeter on the LOT (see Fig. 8-1) to the left (OSD feedback will show ‘Out high’).
6. Turn the Vg2 potmeter slowly clockwise until you read ‘In low’. This is the correct value.

Method 2 (with oscilloscope)
In the frame-blanking period of the R, G and B signals applied to the CRT, the ‘HOP’ video processor inserts a measuring pulse with different DC levels. Measure the black level pulse during the vertical flyback at the RGB cathodes of the CRT.
1. Go, via the MENU key, to the normal user menu, select PICTURE, and set CONTRAST and BRIGHTNESS to 0.
2. Activate the SAM.
3. Connect the RF output of a pattern generator to the antenna input. Test pattern is a 'black' picture (blank screen on CRT without any OSD info).
4. Set the channel of the oscilloscope to 50 V/div and the time base to 0.2 ms. Use external triggering on the vertical pulse (**caution:** use e.g. R3641 **,which is at the ‘cold’ side!**).
5. Ground the scope at the CRT panel (‘cold’ side) and connect a 10:1 probe to one of the cathodes of the picture tube socket (see diagram F).
6. Measure the cut off pulse during first full line after the frame blanking (see Fig. 8-2). You will see two pulses, one being the cut-off pulse and the other being the white drive pulse. Choose the one with the lowest value, this is the cut-off pulse.
7. Select the cathode with the highest V_{DC} value for the alignment. Adjust the V_{cutoff} of this gun with the SCREEN potentiometer on the LOT (see Fig. 8-1) to the correct value (160 ± 3 V_{DC}).
8. Restore CONTRAST and BRIGHTNESS to normal (CONTRAST= 63 and BRIGHTNESS= 34).

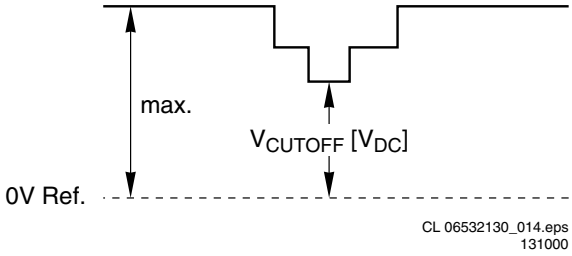


Figure 8-2

8.2.2 Focusing

1. Tune the set to a circle & crosshatch test pattern (use an external video pattern generator).
2. Choose picture mode ‘NATURAL’ with the ‘SMART PICTURE’ button on the remote control transmitter.
3. Adjust the FOCUS 1 potentiometer (upper potmeter, see Fig. 8-1) until the horizontal and vertical lines at 1/4 from east and west, at the height of the centre line, are of minimum width without visible haze.
4. Adjust the FOCUS 2 potentiometer (middle potmeter, see Fig. 8-1) until the horizontal and vertical lines at 1/4 from north and south, at the height of the centre line, are of minimum width without visible haze.

8.3 Software Alignments

8.3.1 Introduction

With the software alignments, it is possible to align the Geometry, White Tone and Tuner IF settings.
Put the set in the SAM (see chapter 5.2.2). The SAM menu will now appear on the screen. Select, via 'Alignments', one of the following submenus:

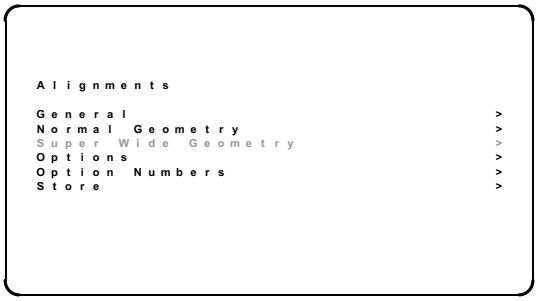


Figure 8-3

- **General**: Select this sub-menu to perform general software alignments.
- **Normal Geometry**: Select this sub-menu to perform standard geometry alignments.
- **Super Wide Geometry**: Select this sub-menu to perform geometry alignments for the 'Panorama' position in 16:9 sets (only valid for wide screen sets). Alignments can be performed; however, it is better to set values as mentioned below.
- **Options**: Select this sub-menu to set the initialisation codes of the set via text menu's.
- **Option Numbers**: Select this sub-menu to set all options at once (expressed in two long numbers). The original factory settings are printed on a sticker that is placed on the CRT (inside the set).
- **Store**: Select this sub-menu to store the performed alignments.

The alignments are explained below in the sequence of the sub-menu.

Note:
- Once all alignments/settings have been completed the item '**Store**' must be selected to record all the values in the permanent memory of the set.
- If the Option codes have been changed and stored, the set has to be switched 'OFF' and 'ON' using the mains switch to activate the new settings (when switching via Standby, the option code settings are NOT read by the microprocessor).
- If an empty EAROM (permanent memory) is detected, all settings are set to pre-programmed default values.
- A built-in test pattern can be called up in various sub-menus. The test pattern generator can be switched on using the item 'Test pattern on/off'. The test pattern only appears AFTER the specific alignment has been selected. The test patterns are generated by the Teletext-IC (OTC).

8.3.2 'General' alignments

Drive
Method 1 (with colour analyser):
1. Select 'Test pattern' and turn it 'On'. You will get a white block in middle of the image now.
2. Select 'Cathode' and adjust the set to the correct light output. This setting depends on the picture tube size and brand. See table 'Cathode parameter' for the colour analyser readings.
3. Select 'Tint' and set it to one of the three colour temperatures ('Cool', 'Normal' or 'Warm')
4. Set the white levels according to the values in the table 'White levels'.

Cathode parameter	
CRT	**Light output (cd/m²)**
28" RF WS	400
32" RF WS	350

CL 16532044_090.pdf
120601

Figure 8-4

White levels			
	Cool	**Normal**	**Warm**
X	280	289	313
Y	287	299	329
Temp. (K)	10200	8700	6500

CL 16532044_091.pdf
120601

Figure 8-5

Method 2 (without colour analyser):
1. Without having a colour-analyser one can set some parameters. This is the next best solution. The setting-parameters are average values coming from production (statistics).
2. Select 'Cathode' and enter the value '15' (for all picture tubes).
3. Select 'Tint' and set it to one of the three colour temperatures ('Cool', 'Normal' or 'Warm').
4. Set the 'Red', 'Green' and 'Blue' parameters according to the values in table 'Tint settings'.
5. 'Red BL offset': herewith the Black Level can be aligned very precise. Default value is 7.
6. 'Green BL offset': herewith the Black Level can be aligned very precise. Default value is 6.

Tint settings			
	δ Cool	**Normal**	**δ Warm**
R	-1	37	+ 4
G	0	30	0
B	+ 4	31	- 8

CL 16532044_092.pdf
120601

Figure 8-6

Luminance delays
With this alignment you place the luminance information exactly on the chrominance information (brightness is pushed onto the colour). Use a colour bar/grey scale pattern as test signal.
- **Lum. Delay Pal**: Apply a PAL colour bar/grey scale pattern as a test signal. Adjust this parameter until the transients of the colour part and black and white part of the test pattern are at the same position.
- **Lum. Delay Secam**: Apply a SECAM colour bar/grey scale pattern as a test signal. Adjust this parameter until the transients of the colour part and black and white part of the test pattern are at the same position.
- **Lum. Delay Bypass**: apply a NTSC colour bar/greyscale pattern as a test signal. Adjust this value until the transients of the colour and black & white part of the test area are at the same position.

EHT compensation
Fixed setting: 5

Soft clipper
Fixed setting:Pwl + 0%

Luma gain
Fixed setting:1

IF AFC
Supply, via an external video generator (e.g. PM5518), a TV signal with a signal strength of at least 1 mV and a frequency of 475.25 MHz. Use system BG if possible, otherwise match the system of your generator with the received signal in the set.

Alignment procedure:
1. Go to the 'Installation' menu.
2. Select 'Manual installation'.
3. Tune the TV-set to the system and frequency described above via 'Search' - '475' - 'OK'.
4. If the frequency, showed in the line 'Fine tune', is between 475.18 MHz and 475.31 MHz, you don't need to re-adjust the 'IF AFC'.
5. If not, adjust the frequency in the 'Fine tune' line to 475.25 MHz and 'Store' the program (this is **very important** because this will disable the AFC algorithm).
6. Now go to the SAM and select 'Alignments' - 'General' - 'IF AFC'.
7. During the 'IF AFC'-parameter adjustment, one can see OSD feedback in the top of the screen. This OSD feedback can give 4 kind of messages:

AFC-window	AFC-frequency vs. reference
Out	High
In	High
In	Low
Out	Low

CL 16532044_093.pdf
120601

Figure 8-7

The first item ('In' or 'Out') informs you whether you are in or out the AFC-window.
The second item ('High' or 'Low') informs you about whether the AFC-frequency is too high or too low.
1. First you must align the 'IF AFC'-parameter such that you come into the AFC-window (= 'In')
2. Then you must look for the point where the 'IF AFC'-parameter changes from 'High' to 'Low'. This level is the value you are looking for.
3. After adjustment, 'Store' the value.
4. Now return to the 'Installation' menu.
5. Select 'Manual Installation' - 'Search' - '475' - 'OK' and 'Store'. This will set the AFC 'on' again.

Service tip: If you do not trust the frequency accuracy of your service generator, connect it to a 'good' TV set and check it with the 'Fine tune'-line.

Tuner AGC
1. Set the external pattern generator to a colour bar video signal and connect the RF output to the aerial input. Set the amplitude to 10 mV and set the frequency to 475.25 MHz.
2. Connect a DC multimeter between pin 1 and the shielding of the Tuner (item 1200 on the LSP).
3. Adjust the 'TUNER AGC' value (default value is 25) with the LEFT/RIGHT cursor keys until the voltage at pin 1 of the tuner lies between 3.8 and 2.3 V.
4. 'Store' the alignment.

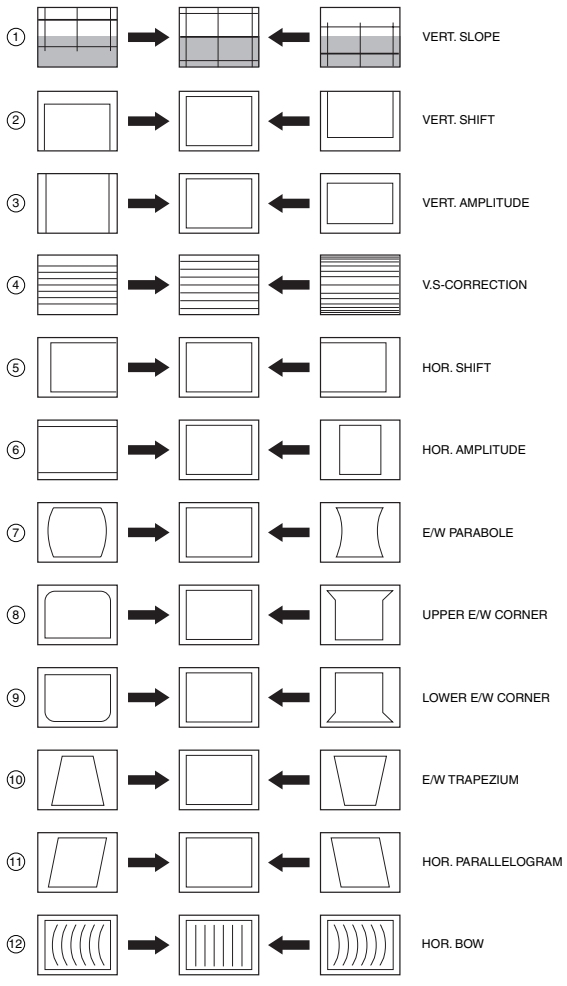
Blend intensity
Use this alignment when you replace the microcontroller or the HOP. It aligns the level of transparency of the menu-picture blended into the main-picture.
1. Position the BRIGHTNESS, CONTRAST and COLOUR setting in the middle position (picture-menu).
2. Apply a signal with a 100 % white video-pattern.
3. Connect an oscilloscope to pin 8 of connector 1298 of the CRT panel and measure the Red output level.
4. Align the 'Blend intensity' parameter such, that the blended signal is 65 % of the black-white amplitude. In practice this is about 1.3 V (blended signal) versus 2 V (full white signal).
5. The parameter can be adjusted in between 0 and 31.

Adjust Peak White Limiter
Enter value '4' for all picture tubes.

Vg2 Test Pattern
In this sub-menu, you can turn 'On' the OSD feedback for the Vg2 alignment (see chapter 8.2.1).

8.3.3 'Normal Geometry' alignments

Introduction
Use for all geometry alignments, an external pattern generator with a geometry pattern (e.g. crosshatch). See figure below for the correct alignments.



CL 16532044_022.eps
140501

Figure 8-8

Warning: The use of the 'Internal Test Pattern' will, at this moment, lead to a mis-alignment of the picture geometry. So use an external generator with a geometry pattern (e.g.

crosshatch) for a correct geometry alignment. Use the 'Internal Test Pattern' only for the 'Vertical slope' alignment.

V. slope
This alignment is meant to align the zero crossing of the frame deflection to the mechanical middle of the picture tube.
1. Set 'Test Pattern' to 'On' (read warning above).
2. Set the 'V. S-correction' value to '0' all sets (the boundary-stripes of the test pattern should be positioned on the edge of the picture tube).
3. Align 'V. slope' (when aligning, the lower half of the picture is blanked) such, that the middle line of the test pattern is matched with the edge of the pattern transient in the middle of the picture.
4. Push the 'MENU' button to return to the previous menu.

Vertical alignment
1. Use 'V. amplitude' to align the vertical amplitude so that the entire test pattern is visible.
2. Set 'V. shift' to value '32'.
3. Connect a voltmeter (V_{DC}) between R3624 and 'hot' ground.
4. Adjust the DC voltage to '0' with potmeter R3642.
5. Use 'V. shift' again to align the test pattern vertically in the middle.
6. Repeat the the alignment if necessary.

Horizontal alignment
1. Use 'H. amplitude' to align the horizontal amplitude so that the entire test pattern is visible.
2. Use 'H. shift' to align the picture horizontally in the middle.
3. Repeat the 'H. amplitude' alignment if necessary.

Note: In case the horizontal linearity in wide-screen mode is out of tolerance, add a 'DC-shift correction' panel (3104 328 06230) to connector 1419 of the DAF-panel [I]. Be sure to switch 'off' the set first.
On the DC-shift panel, cut diode 6433 for correction to the right or diode 6432 for correction to the left.
Caution: never plug in a *not pre-aligned* module in a set !!!

East/west alignment
1. Use 'East/West Parabola' to align the vertical lines until straight.
2. Use 'Upper East/West corner' to align the vertical lines in the upper corners until straight.
3. Use 'Lower East/West corner' to align the vertical lines in the lower corners until straight.
4. Use 'East/West Trapezium' to align for a rectangular.
5. Use 'Horizontal Parallelogram' to align for straight vertical lines if necessary.
6. Use 'Horizontal Bow' to correct the E/W parabola such, that it becomes symmetrical. Default value is '31'.
7. Repeat steps 1 to 6 if necessary.

8.3.4 'Super wide geometry' alignments (only for widescreen sets)

Note: The header of this paragraph and also the menu's are somewhat misleading. We only need to set the following values (if the normal geometry alignment has been performed correctly):
1. For 'V. shift' use the default value 33.
2. For 'V. amplitude' use the default value 25.
3. 'V. S-Correction', enter value of 'normal geometry' alignment.
4. 'H. amplitude', enter value of 'normal geometry' alignment subtracted by 1.
5. 'East/west Parabola', enter value of 'normal geometry' alignment.

8.4 Option Settings

8.4.1 Introduction

The microprocessor communicates with a large number of I^2C ICs in the set. To ensure good communication and to make digital diagnosis possible, the microprocessor has to know which ICs to address. The presence / absence of these specific ICs (or functions) is made known via the option codes.

You can set the 'hardware related' options via the SAM - 'Alignments' - 'Options' or 'Option Numbers' menu.
You can set the 'software related' options via the SAM - 'Dealer Options' menu .

After you have changed the option(s), save them via the 'Store' command.

The new option setting is only active after the TV is switched OFF and ON again via the mains switch (the EAROM is then read out again).

8.4.2 Options

Select this sub-menu to set the initialisation codes (= options) of the set via text menu's.

Menu-item	Subjects	Options	Physically in the set
Dual screen/PIP	Aux type	None	Feauture not present.
	Text Dual Screen	Yes	Text Dual Screen present
		No	Text Dual Screen not present
Teletext/EPG	TXT	Yes	Teletext present
		No	Teletext not present
	NextView present	Yes	NextView set
		No	NextView not set
	NextView type	Flashram	Flash-RAM present
		No Flashram	Flash-RAM present
Communication	Easylink Plus	Yes	Easylink Plus set
		No	Easylink Plus not set
Picture Tube	CRT Type	4:3	4:3 picture tube
		16:9	16:9 picture tube
	Picture Rotation	Yes	Frame rotation circuitry present (diagram A5)
		No	Frame rotation circuitry not present
	Dynamic focus	Yes	Dynamic focus (DAF) present (diagram I)
		No	Dynamic focus (DAF) not present
	One Point Control	Yes	
		No	
Video repro	Featurebox type	Eco	PROZONIC not present
		Prozonic	PROZONIC present
		Falconic	FALCONIC present
		1050i/1250i	Progressive scan mode
	Field memories	2	
		3	
	Lightsensor	Yes	Lightsensor present
		No	Lightsensor not present
	PALplus	Yes	PALplus module present
		No	PALplus module not present
	Combfilter	Yes	Not valid for Europe
		No	
	Picture improvement	Yes	LTP present
		No	LTP not present
	Picnic	Yes	PICNIC present
		No	PICNIC not present
	Picnic AGC	Yes	In normal operation: Yes
		No	During 'Drive' alignments: No
	Signalling bits	Yes	
		No	
Source Selection	External 3	Yes	3rd EURO connector present (diagram H)
		No	No 3rd EURO connector present
	External 4	Yes	4th EURO connector present
		No	No 4th EURO connector present
Audio Repro	Dolby	None	
		Pro Logic	
	Rear speakers	Corded	Passive surroundbox present
		Virtual	Virtual Dolby (without rear speakers)
		Cordless	Active surroundbox present
	Acoustic system	FL9 Monitor	Modern design with only tweeters at both sides (monitor look)
		FL9 DAS	Modern design with full range speakers at both sides
		FL12	Soft design with full range speakers at both sides
	Virtual Dolby	Yes	
		No	
	AVL	On	Automatic Volume Limiter on
		Off	Automatic Volume Limiter off
Miscellaneous	Heatsink Present	Yes	Heatsink present on CRT/SCAVEM panel (diagram F)
		No	Heatsink not present on CRT/SCAVEM panel (diagram F)
	Tuner type	UV1316	
		TEDE9	

CL 16532044_041.eps
150501

Figure 8-9

8.4.3 Option numbers

Select this sub-menu to set all options at once (expressed in two long numbers).

An option number (or 'option byte') represents a number of different options. When you change these numbers directly, you can set all options very fast. All options are controlled via eight option numbers.

When the EAROM is replaced, all options will require a re-setting. To be certain that the factory settings are reproduced exactly, you must set **both** option number lines. You can find the correct option numbers on a CRT sticker inside the TV set.

Example: The CRT sticker in the 32PW8870 gives the following option numbers:
04866 04384 08001 00016
12407 00001 00000 00071
The first line indicates the hardware options 1 to 4, the second line is reserved for the software options.
Every 5-digit number represents 16 bits (so maximum number can be 65536 if all options are set).

When all the correct options are set, the sum of the decimal values of each Option Byte (OB) will give the option number.

OB	Bit	Option name	Settings (given in decimal values)		Option number
0	0	Cabinet	0 = FL6 (n/a) 2 = FL8 (n/a) 4 = FL9 Monitor 6 = FL11 (n/a)	1= FL7 (n/a) 3 = FL9 DAS 5 = FL10 (n/a) 7 = FL12	Sum OB0
	1				
	2				
	3				
	6	AVL	0 = Off	64 = On	
1					Sum OB1
2	0	CTI	0 = Off	1 = On	Sum OB2
3	0	Auto TV	0 = Off	1 = On	Sum OB3
	1	Auto Store Mode	0 = None 4 = TXT Page	2 = PDC/VPS 6 = PDC/VPS/TXT Page	
	2				
	3				
	4	Picture Mute	0 = Off	16 = On	
	5	Demo	0 = Off	32 = On	
	6	Virgin	0 = Off	64 = On	
	12	TXT Preference	0 = TOP	4096 = FLOF	
	13	TXT Region	0 = East	8192 = West	
4	0				Sum OB4
	2	China IF	0 = Off	4 = On	
	3	Tuner	0 = Philips	8 = Alps	
	4	TXT	0 = Off	16 = On	
	5	China TXT	0 = Off	32 = On	
5	0	EXT3	0 = Off	1 = On	Sum OB5
	1	EXT4	0 = Off	2 = On	
	4	Dual Screen	0 = None 32 = Dual Screen	16 = PIP	
	5				
	6	TXT/EPG/DS	0 = Off	64 = On	
	7	Aux. Headph. Sound	0 = Off	128 = On	
	8	Aspect Ratio	0 = 4:3	1 = 16:9	
	9	Tilt	0 = Off	512 = On	
	10	DAF	0 = Off	1024 = On	
	11	One Point Control	0 = Off	2048 = On	
	12	Heat Sink	0 = Off	4096 = On	
	13				
	14	Home Cinema	0 = Off	16384 = On	
6	0				Sum OB6
	1	Dolby ProLogic	0 = Off	2 = On	
	2	Virtual Rear Spkrs	0 = Off	4 = On	
	3	Cordless Rear Spkrs	0 = Off	8 = On	
	4	Dolby Digital	0 = Off	16 = On	
	5	Virtual Dolby	0 = Off	32 = On	
	8	P50 Easylink	0 = Off	256 = On	
	12	EPG	0 = Off	4096 = On	
	13	EPG Type	0 = Type 2	8192 = Type 2C3	
7	0	Featurebox	0 = Eco 2 = Melzonic (n/a)	1 = Prozonic 3 = Falconic	Sum OB7
	1				
	2				
	3	Comb Filter	0 = Off	8 = On	
	4	PALplus	0 = Off	16 = On	
	5	Field Memories	0 = 2 memories	32 = 3 memories	
	6	Light Sensor	0 = Off	64 = On	
	7	Luma Trans. Proc.	0 = Off	128 = On	
	8	PICNIC	0 = Off	256 = On	
	9	PICNIC-AGC	0 = Off	512 = On	
	10				
	11	LNA	0 = Off	2048 = On	
	12	WSS	0 = Off	4096 = On	
	13	Time Constant	0 = Normal	8192 = Fast	

CL 16532044_042.eps
150501

Figure 8-10

8.4.4 Dealer Options

Menu name	Subjects	Options	Physically in set
Picture	CTI	Yes	CTI enabled
		No	CTI disabled
Personal	Blue Mute	Yes	Blue mute activen case no picture detected
		No	Noise in case of no picture detected
	Virgin Mode	Yes	TV starts up once with language selection menu after mains switch on for the first time (virgin mode)
		No	TV does not starts up once with language selection menu after mains switch on for the first time (virgin mode)
	Auto Store Mode	None	Autostore mode disabled (not in installation menu)
		PDC-VPS	Autostore mode via ATS (PDC/VPS) enabled
		TXT page	Autostore mode via ACI enabled
		PDC-VPS-TXT	Autostore mode via ACI or ATS enabled
	Demo Menu Enable	Yes	Demo menu enable
		No	Demo menu disable
	Auto TV	Yes	Auto TV mode enabled
		No	Auto TV mode disabled
Teletext	TXT Preference	TOP	Preference to TOP Teletext
		FLOF	Preference to FLOF Teletext
	East/West TXT	West	TXT characters for non -/58 sets
		East	TXT characters for -/58 sets

CL 16532044_043.eps
150501

9. Circuit Descriptions and Abbreviation List

Index of this chapter
1. Introduction
2. Block diagram
3. Power supply
4. Control
5. Tuner & IF
6. Video: High-end Input Processor
7. Video: Feature box
8. Video: High-end Output Processor
9. Synchronisation
10. Horizontal deflection
11. Vertical deflection
12. Audio
13. Teletext / NexTView
14. CRT / SCAVEM / Rotation
15. Software related features
16. Abbreviation list

9.1 Introduction

The EM3 Europe is a higher specified chassis as the EM2 Europe. EM stands for Eco-MG, 3 for an indication that this set is higher specified as the EM2E. So EM2E is a known chassis with Digital Scan, EM3E is set with Natural Motion, EM4E will be the EM3E set inclusive a Digital Reception board. -
Differences between the EM3E versus EM2E:
– the start-up method is much more simple (no POR-bit anymore)
– the set has an advanced Standby Power Supply, including MOSFET-switches for making Semi-standby (needed for Easylink and digital reception in future)
– added features as Natural Motion, EPG, LTP and upgraded Auto-TV
– the sound amplifiers have symmetrical supply voltages now. The IC is changed from TDA2616 to TDA7490 (class-D amplifier, needing very little cooling)
– the vertical amplitude hardware alignment is changed to a software alignment via the SAM menu
– the vertical shift alignment is split into a hardware ***and*** a software alignment (needed due to spread)
– the Frame drive signals from the HOP are symmetrical.

The architecture consist of a conventional large signal panel (LSP) and a small signal board (SSB) module, placed into a so called SIMM-connector (Standard Interface, 80 pins).

The LSP is built up very conventional, with hardly any surface mounted components on the copper side. Similar with the EM2E (but different as with the MG-chassis), the EM3E LSP has a very large 'hot' part, including both deflection coils.

The SSB is a high tech module (2 sides reflow technology, full SMC) with very high component density and complete shielding for EMC-reasons. Despite this, it is designed in such a way, that repair on component level still is possible. To achieve this, attention was paid to:
- The position of service test lands: most of them are at the Tuner side.
- Accessibility (Tuner side). If there are still problems with the accessibility, one can order an extension board (see parts list).
- Clearance around surface mounted ICs (for replacing).
- Detailed diagnostics and fault finding is possible via ComPair.

Attention: During the first 4 to 6 months of production, the EM3E set-software will be integrated into a Flash-RAM on the SSB. After that period, a Mask-ROM will be used. Which IC is used is not of interest for Service, however for both solutions it means that Service Workshops must be equipped with dedicated (de) solder equipment for exchanging these ICs.
In case one must replace a Flash-RAM or a Mask-ROM in the field, the Dealer will receive always an up-to-date Flash-RAM.

Warning: Be aware that half of the LSP-circuitry is 'hot', including the deflection coils.

9.2 Block Diagram

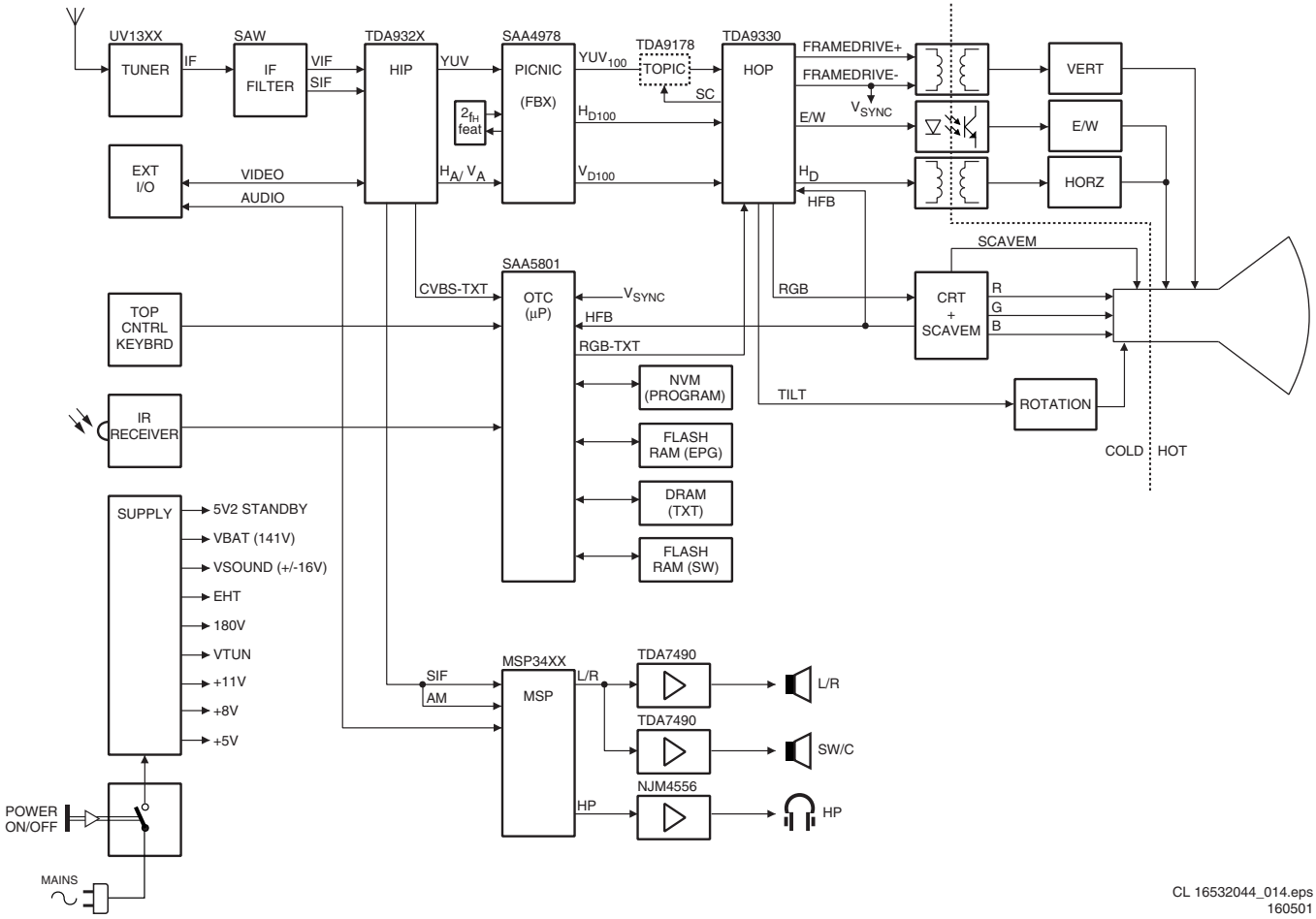


Figure 9-1

The Tuner (item 1200) is a PLL tuner and delivers the IF-signal, via audio & video SAW-filters, to the HIP (High-end Input Processor). The HIP has the following functions:
- IF modulation.
- Video source- and record select.
- Colour decoder.
- Synchronisation.

Three SCART-connectors can be used:
– SCART1 is fully equipped,
– SCART2 is meant for VCR. Pin 10 is used for Easylink and there is a possibility for Y/C in. The CVBS-out on pin 19 is meant for WYSIWYR (What You See Is What You Record).
– SCART3 is a CVBS and audio L/R input.

The HIP delivers YUV and sync signals to the PICNIC. This IC takes care of:
- Analogue to Digital conversion and vice versa.
- 50 to 100 Hz conversion.
- Panorama mode.
- Noise reduction.
- Dynamic contrast.

The '2fH features'-block in the diagram gives several options:
– for Digital Scan the PROZONIC is required
– for Natural Motion the FALCONIC is required.

After the PICNIC the, now 100 Hz, YUV- and H/V-signals are fed to the HOP (High-end Output Processor). This IC handles the video control and geometry part. The RGB-signals for TXT/OSD (from the µP) are also inserted via the HOP. The video part delivers the RGB signals to the CRT-panel and the geometry part delivers the H-drive, V-drive and also a drive-signal for rotation.

Both deflection circuits are 'hot' and located on the LSP. They are driven by the HOP. To make a galvanic separation, the Line Drive is driven via transformer 5410 and the Frame Drive via transformer 5621.The horizontal output stage generates some supply voltages and the EHT-, focus- and Vg2-voltages.

The RGB amplifiers on the CRT-panel are integrated in one IC and are supplied with 200 V from the LOT.
The SCAVEM circuit modulates transitions of the Luminance (Y) signal on the horizontal deflection current, giving a sharper picture.

The sound part is built around the MSP34xx (Multi-channel Sound Processor) for IF sound detection, sound control and source selection. Dolby decoding is also done by the MSP. Amplification is done via a 'class D' integrated power amplifier IC, the TDA7490.

The microprocessor, called OTC (OSD, Teletext and Control) takes care of the analogue TXT input- and output processing. The OTC, ROM and RAM are supplied with 3.3 V, which is derived from the +5V2STANDBY.
The NVM (Non Volatile Memory) is used to store the settings, one Flash-RAM contains the set software, the other Flash-RAM (7012) is for EPG and the DRAM is used for storing the Teletext pages.

In EM3E there is a separate Standby Supply, in order to reduce the Standby power consumption. During Standby, the

Main Supply is switched 'off' (via TS7529). A relay (1550) is used to switch the Degaussing circuit. It is switched 'on' after set start-up and switched 'off' by the µP after 12 s.
The Main Supply, an SMPS that is based on the 'down-converter' principle, generates the 141 V (V_{BAT}) and the +/- 16 V for the audio part. Difference with former MG-sets is that V_{BAT} is **not** mains isolated ('hot') and is alignment free.

9.3 Power Supply (diagram A1 & A2)

The power supply has a number of main functions:
- Mains harmonic filter.
- Degaussing picture tube.
- Standby power supply.
- Main supply.

9.3.1 Mains Harmonic Filter (diagram A1)

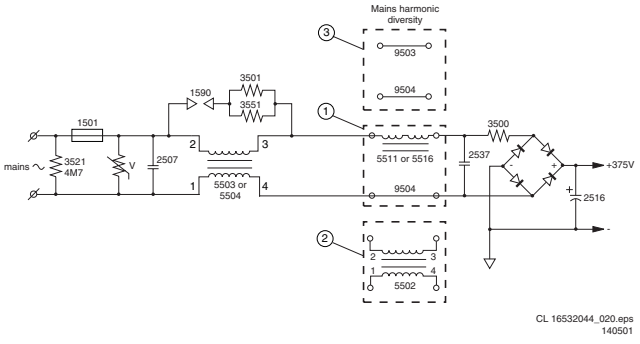


Figure 9-2

The mains harmonic filter has 2 functions: to prevent that high frequency signals (harmonics) are transferred into the mains and to protect the set from lightning damage.

C2507 prevents that the high frequency signals, generated by the set, are conveyed into the mains (it forms a short-circuit).

In case of a lightning surge between the 2 phases (differential mode) the energy is immediately bled away through the VDR (R3509) to the other phase.
In case of a lightning surge on both phases of the mains in relation to the aerial earth, the filter acts as a high resistance (U_{EMK}=L * dI/dt), as a result of which the voltage across coil L5503/04 increases. A spark gap (1590) prevents that the voltage increases too much, which would lead to a damaged coil. When ignited, the current will be discharged via this spark gap.
Resistor R3500 is used for limiting the inrush-current.

9.3.2 Degaussing (diagram A1)

The 5V2 is present, as soon the set is switched 'on' via the mains switch. As the 'DEGAUSSING' signal from the processor (OTC) is 'low', transistor 7528 will conduct and relay 1550 is activated. Initially a considerable current will flow, via PTC 3516, through the degaussing coil. The PTC will heat up, resistance will rise and the current will decay rapidly. The OTC makes the 'DEGAUSSING' signal 'high' after 12 s, which will switch the relay 'off'.

9.3.3 Standby power supply (diagram A2)

Principle
This power supply is of a SOPS type (Self-Oscillating Power Supply) and is regulated by the controlled switching of an oscillator. It uses the so-called 'Flyback' principle:

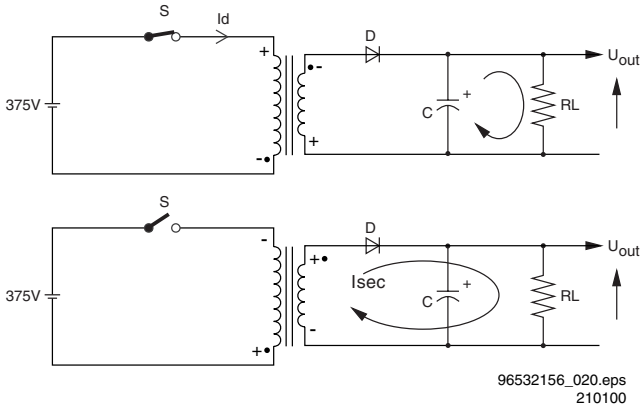


Figure 9-3

- After closing switch 'S', the current ID will increase linear in time. The magnetic energy in the primary coil is directly proportional with the self-inductance of the coil and current ID (thus with the time the switch is closed). The voltage polarity at the secondary winding is negative (due to different winding direction), meaning that diode D will block. Capacitor C will discharge via RL, U_{OUT} will decrease.
- Opening switch 'S' will generate a counter-e.m.f. in the primary winding, trying to maintain current ID. Through this the polarity of the secondary voltage will inverse. The magnetic energy, stored in the coil, will now be transformed to the secondary side. Diode D will now conduct, capacitor C will be charged and $_{OUT}$ will increase.

Implementation

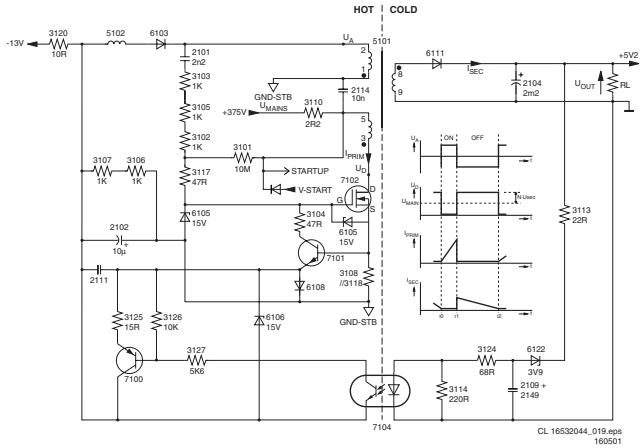


Figure 9-4

To apply this on the EM3E (diagram A2): replace switch 'S' by FET TS7102, coil L by L5101/L5100, diode D by D6111 and C by C2104.

– **Time interval t0 - t1:** After switching 'on' the TV-set, the gate of MOSFET TS7102 will be high (max. 15 V due to zener diode D6105). This will drive the FET into saturation (U_{DS} = 0 V). The DC-voltage U_{MAINS} will be transposed across the primary winding of L5101 (3, 5), resulting in a linear increasing current through this coil. The voltage across the co-coupled coil (1, 2) is also positive and will keep the FET into conductivity via C2101, R3103/3105/3102 and R3117 for some time. The self-induction of the coil and the magnitude of the supply voltage (+375 V) determine the slope of the primary current. The maximum current is determined by the time the FET stays into conductance (t0 - t1). This time is directly determined by the voltage across R3108/

/R3118 (= 5 Ω). This voltage is a measure of the current and if it exceeds 1.4 V, TS7101 will be driven into conductivity and consequently connects the gate of TS7102 to earth. The FET will block. The current is: 1.4 V / 5 Ω = 0.28 A. The voltage across the secondary winding (8,9) will be negative, diodes D6111 and D6107 will block.

– **Time interval t1 - t2:** The sudden current interruption in the primary coil will induce a counter-e.m.f. that wants to maintain the current. The voltage on the drain of the FET will increase. The secondary voltage (8, 9) will become positive and will charge C2104 via D6111. All energy that was stored in L5101 during t0 - t1 will be transferred into the load. Due to the transformer principle, a voltage will now be induced in the primary winding (3, 5) and the co-coupled winding (1, 2). This voltage will be N* U_{SEC} (N= winding ratio). The voltage across the co-coupled coil will be negative, keeping the FET blocked.
– **Time t2:** At t2, the current through the secondary coil will be reduced to zero, as C2104 is no longer charged. As a consequence, the voltages will decay and will change polarity. The gate of the FET will be again made positive, is driven into conductivity and the cycle starts again.

Feedback and stabilisation

The Standby Power Supply always oscillates at maximum power. The only limiting factor is the maximum primary current, which has been pre-set with R3108//3118.
R3114, R3124, R3113 and zener diode D6122 determine U_{OUT}. If the voltage across R3114 exceeds the threshold voltage of the diode of the optocoupler 7104 (± 1 V) or, in other words, U_{OUT} exceeds 5.2 V, the transistor of the optocoupler will conduct.
Transistor TS7100 is now driven, and a negative voltage will be transposed to the emitter of TS7101. When TS7101 conducts, the gate of the FET is at earth potential, forcing the oscillator stop. Due to the load, the secondary voltage $_{OUT}$ will decrease. At a certain voltage, optocoupler TS7104 will block and the oscillator will start again.
Since there are no capacitors, and there is a high amplification factor in the feedback circuit, the feedback is ultra-fast. This is why the ripple on U_{OUT} is minimal. The negative supply voltage (-13 V) used in the feedback circuit, originates from the co-coupling coil and is rectified through D6103.
Stabilisation is not affected through duty-cycle control but through burst-mode of TS7100.
Burst-mode is load dependent. If the power supply is less loaded, the secondary voltage will have the tendency to increase more rapidly. If the load on the power supply increases, then the oscillator stops less often, right up to the moment that the oscillator is operating continuously: maximum load. If the power supply is now loaded even more, the output voltage will decay. The maximum primary current set by R3108//3118 determines the maximum load.

Protection

If the optocoupler would fail, the secondary voltage will increase. This would have disastrous consequences since many ICs (e.g. OTC, Flash-RAM and DRAM) are fed with this 5.2 V. In other words; very expensive repairs would be required.
We already know that the negative supply is directly dependent upon the secondary 5.2 V, as a consequence of which the negative supply will increase proportionally as the secondary voltage increases.
If the negative supply in the mean time reaches -15 V, D6106 will start to zener and as a consequence TS7101 will start conducting. Basically, D6106 will take over the stabilisation task of the optocoupler, however, with a considerable spread: from -13 V to -15 V is a 15 % increase, thus $_{OUT}$ will increase from 5.2 V to max. 6 V.

Tuner Supply

The Standby supply produces 2 voltages for the Tuner: +33V (V_{TUN}) and +5VT.

- The +33V is the tuning voltage for the Tuner.
- The +5VT is derived from the +8V with stabiliser 7911, and is used to supply the tuner only.

SSB Supply

There are several voltages going to the SSB: +8V, +5V and +3V3.

- The +5V and +(always present) come directly from the Standby power supply.
- The +3V3 is derived from the +5V with stabiliser 7910 (on the LSP).

9.3.4 Main Supply (diagram A1)

Some **important** notes on beforehand:

- V_{BAT} is not isolated from the main supply ('hot').
- V_{BAT} is alignment free.

Principle

The Main Power Supply, generates the 141 V (V_{BAT}) and the +/- 16 V for the audio part. It is based on the so-called 'down converter' principle.

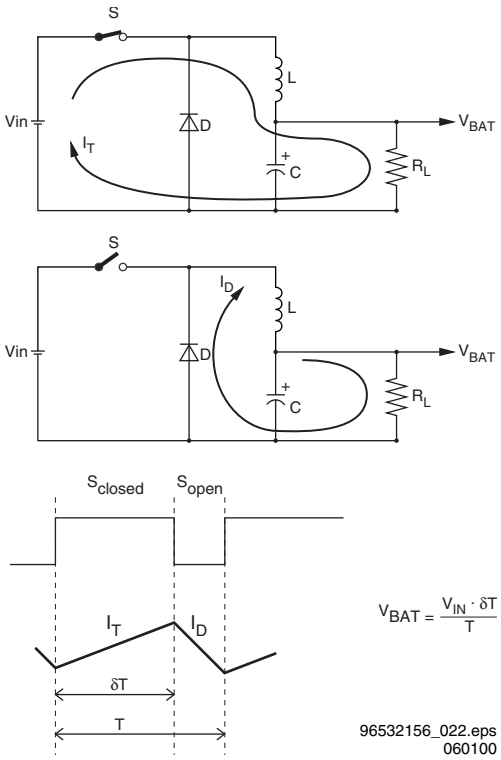


Figure 9-5

- After closing switch 'S', the linear in time increasing current I_T, will charge capacitor C.
- Opening switch 'S' will generate a counter-e.m.f. in coil L, trying to maintain current I_T. This is possible via diode D (this diode is also called 'freewheel diode'). So after opening 'S', the magnetic energy stored in coil L will be transferred to electrostatic energy in capacitor C. The V_{IN} will only supply current during the time that 'S' is closed while a constant current is flowing through RL.
- V_{BAT} is directly proportional with V_{IN} and the time that 'S' is closed and reverse proportional with period time 'T'. So by changing the duty cycle, it will be possible to control V_{BAT}.

Implementation

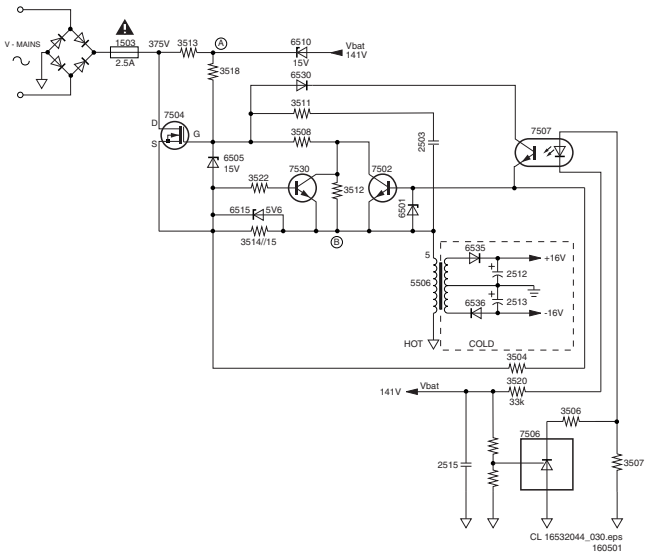


Figure 9-6

At start-up of the main supply, C2515 can be assumed as being a short-circuit. U_{AB} will be 15 V (R3513, D6510) and U_{GS} of the FET will be +5.4 V. The FET will be driven into saturation (same as closing switch 'S'). The drain-current will increase linear in time. With other words: resistors R3513 and R3518 will start the oscillator.
The voltage across the co-coupled coil (4, 5) is also positive and will keep the FET into conductivity.

The drive concept of the MOSFET TS7504 has changed (compared to the EM2E chassis). In EM2E, TS7502 was a high-voltage semiconductor, in EM3E it is changed to a low-voltage semiconductor. The added opto-coupler 7505 is used to bridge the different voltage levels.
Via this opto-coupler, the DC-current through R3504 is influenced. The changed current through R3504, changes the V_{BE} of TS7502, which will influence the drive of MOSFET TS7504 (= switch 'S' in Fig. 5).

The sudden current interruption in the primary coil, will induce a counter-e.m.f. that wants to maintain the current via the 'freewheel' diode D6508. This current is linear decreasing in time and as it is also flowing through R3414//R3415, TS7502 will be blocked after a certain time period. The gate of the FET will be again made positive, is driven into conductivity and the cycle starts again.

For safety reasons, transistor TS7530 is added as a back-up solution for TS7502. If B-E of TS7502 is shorted, TS7530 takes over its function.

Stabilisation of V_{BAT}
The output voltage V_{BAT} is determined by: $V_{BAT} = V_{IN} * T_{ON} / (T_{ON} + T_{OFF}) = V_{IN} *$ duty-cycle.
To stabilise the output voltage, a feedback loop is implemented, which will reduce T_{ON} when V_{BAT} increases and vice versa.

Via a voltage divider, excisting of (1 %) resistors R3507, R3510 and R3527, a voltage of 2.5 V (when V_{BAT} = 141 V) is fed to the input of precision shunt regulator 7506. This regulator will conduct, a current will flow through the diode part of the opto-coupler 7507. The base of TS7502 will now be set at a certain positive voltage. As this transistor switches the FET TS7504 on and off, this circuit can determine the duty-cycle.
E.g. when the load increases, V_{BAT} will decrease. As a consequence, the input voltage of regulator 7506 will decrease, resulting in a lower current. Via opto-coupler 7505 and transistor TS7502, T_{ON} of the FET is changed (will increase). The output voltage V_{BAT} will rise.
If the load continues to increase, the regulator will block at a certain moment. T_{ON} will is now at maximum value. This is the point where V_{BAT} will go below 141 V and, at further increasing load, is switched 'off' (the voltage across the co-coupled coil (4, 5) will decrease, due to the increasing load. Therefore the voltage on the gate of TS7504 comes below the threshold voltage. The supply switches 'off' and an audible hiccuping can be heard).
On the other hand when the load decreases, V_{BAT} will rise. As a consequence, the input voltage of TS7506 will also rise, resulting in a higher current. This changes the base voltage of TS7502, and through that the T_{ON} (will decrease) of the FET. The output voltage V_{BAT} will be reduced.
If, for instance, V_{IN} will decrease (e.g. U_{MAINS} is 180 V i.s.o. 240 V), the slope of the drain-current will be flattened, through which the FET will be longer into conductance, keeping V_{OUT} constant.
If, for any reason, the stabilisation circuit might fail, the output voltage V_{BAT} can never exceed 200 V (via D6514). D6514 will form a short-circuit, V_{BAT} will drop and the set will switch off (this will result in an audible hiccuping of the supply).

Switch to 'Standby' (via RC)
When the set is switched to 'Standby' mode via the Remote Control, the Main supply is switched 'off' by the circuit around TS7529 (see diagram A1).
During 'on'-state, the Main supply is fed with line pulses via the 'SUP-ENABLE' line. They are rectified and smoothed via D6517, D6516 and C2530 and fed to TS7529. Because they are less than -13 V, this transistor is blocked. When these pulses are stopped, TS7529 will be saturated and TS7502 will switch 'off'. This will switch 'off' the Main supply.

Set to 'On' (via 'SUP-ENABLE')
Via the 'STANDBY' command from the OTC, the MOSFETS 7141 and 7131 are switched 'on'. When the +5V and +8V are sensed by the OTC, a command is given to the HOP to start the drive (via I^2C).
When this is sensed via the 'SUP-ENABLE' line (at the base of line transistor TS7421), the main supply is switched 'on' via TS7529.

Audio Supply
The pulses on the secondary winding of L5506 are rectified by D6535 (+16 V) and D6536 (-16V), and smoothed by C2542 and C2543.

9.4 Control (diagram B5)

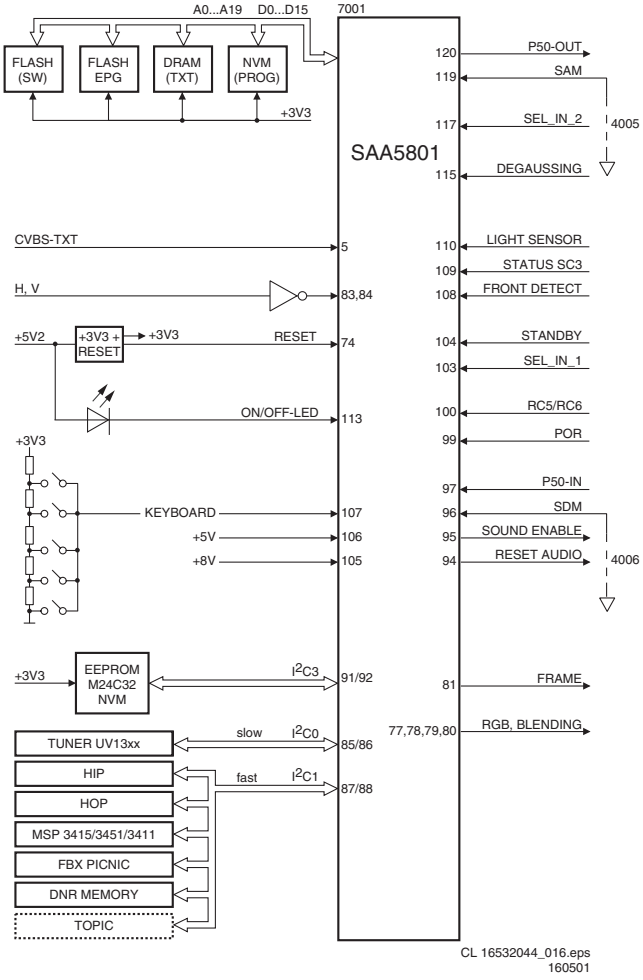


Figure 9-7

9.4.1 OTC

Introduction

The SAA5801 (IC7001) is called the OTC (OSD, TXT and Control). In this IC, the microprocessor and the TXT-decoder (level 2.5) are integrated.
Some of its functions are:

- Set control.
- TXT/OSD acquisition.
- RGB-outputs to the HOP
- Menu blending; for blending the contrast, software controlled.
- I/O-ports for I^2C, RC5/RC6, LED, and service modes.
- Error code generation.

Data Storage

The software for EM3E can be 2 MB (Megabyte).
It is possible to store 1200 TXT pages in IC7007. This is a DRAM of 4 MBit and this IC is also used to store data of a working set.
For EPG a Flash-RAM (7012) is used.
The Non Volatile Memory IC7011 is a 4 kB version M24C32W6.

Power Supply

All ICs in this part are supplied with 3V3. For this voltage a 3V3 stabiliser is used (IC7005).

With the circuitry around TS7003 and 7004 (diagram B5) a reset is generated to wake up the OTC (pin 74). During this reset all I/O pins of the OTC are made 'high'.

Via pins 105 and 106, the +8 V and the +5 V are sensed. If one of them is not present, the Main supply is switched 'off' (set in protection and the red LED will blink at 3 Hz).
The OTC will generate an error code to indicate what was wrong.

OSD/TXT

The horizontal (H_{D100}) and vertical (V_{SYNC}) sync pulses are also fed to the OTC for stable OSD and TXT.
The RGB-outputs (77/78/79) together with fading (pin 80) are fed to the HOP. The fading pin has a double function: it is used for making a transparent menu and as fast-blanking signal for TXT.

9.4.2 I^2C Busses

In the EM3E chassis with OTC-processor there are three I^2C busses used:

- Slow (max. 100 kHz) hardware I^2C-bus (called I^2C0), used for the Tuner.
- Fast (max. 400 kHz) hardware I^2C-bus (called I^2C1), used for all ICs.
- Separate short bus (called I^2C3) for the Non Volatile Memory (NVM), to avoid data corruption.

9.4.3 NVM

The Non Volatile Memory contains all set related data that must be kept permanently, such as:

- Software identification.
- Operational hours.
- Error-codes.
- Option codes.
- All factory alignments.
- Last Status items for the customer + a complete factory recall.
- Txt featuring (keeping habit watch data).
- EPG data.

9.5 Tuner & IF (diagram A8 & B2)

The tuner is I^2C controlled, and is capable of receiving off-air, S- (cable) and Hyperband channels:

- Low 44 - 156 MHz
- Mid 156 - 441 MHz
- High 141 - 865 MHz

The tuning is done via I^2C. The reference voltage on pin 9 is 33 V. This voltage (V_{TUN}) is derived from the secondary side of the standby supply, via D6134 and R3116//R3115 and a 33 V zener diode (D6200). The OTC, together with the HIP, controls the tuning procedure. There is also automatic switching for the different video systems.

The IF-filter is integrated in a SAW (Surface Acoustic Wave) filter. The type of this filter depends on the received standard(s). There are two SAW filters: one for filtering picture-IF and a second one for sound-IF. An extra filter (5403), tuned at 40.4 MHz, is necessary for L/L' sets (with 6.5 MHz sound), to suppress the neighbour channel.

The output of the tuner is controlled via an IF-amplifier with AGC-control. This is a voltage feedback from pin 62 of the HIP to pin 1 of the tuner. AGC take-over point is adjusted via the service alignment mode 'Tuner AGC'. If there is too much noise in the picture, it is possible that the AGC setting is wrong. It is also possible that the AGC-setting is mis-aligned, if the picture deforms with a perfect signal. Then the IF-circuit amplifies too much.

The video IF-signal is fed to pins 2/3 of the PLL-controlled IF-demodulator. The voltage controlled oscillator of the PLL is

adjusted via the service menu 'IF AFC'. If the alignment is correct, the displayed frequency in the installation menu is the same as the applied frequency from a generator. The external coil L5408 connected between pins 7/8 is used as reference.
The demodulated IF-video signal is available at pin 10 of the HIP. In this video signal, there is a rest of the sound carrier, which is filtered out by the sound trap 1407.
Then the signal is again fed to the HIP on pin 12, where the group delay is corrected, dependent on the standard that is received.
The CVBS-signal is available at pin 13 for further processing in the set. Via TS7322, the signal is supplied to EXT1 (monitor out) and again back into the HIP (pin 14) to the source/record selection.

To realise Quasi Split Sound (QSS), the IF-signal is fed to the HIP on pin 63/64 via SAW-filter 1405. The FM (or AM for L-norm) -modulated signal is available on pin 5 and is fed to the audio demodulator MSP34xx (7651).

9.6 Video: High-end Input Processor (HIP, diagram B2))

In the EM3E, the HIP TDA932xH is used, which contains the following functions:
- IF demodulation.
- Group delay correction.
- AFC signal generation, used to track drifting transmitters.
- Sound carrier re-generation (SIF).
- AM demodulation.
- Sync acquisition, delivering H_A and V_A.
- Switching off IF-filtering.

9.6.1 Inputs

The HIP has various inputs:
- Full matrix switch with:
  - 2 CVBS inputs
  - 2 Y/C (or additional CVBS) inputs
  - 1 CVBS front end input.
- Two RGB inputs and 2 status-inputs

The input signals from the Front I/O are fed to the HIP, and front detection is fed to the OTC.
- EXT1 is full SCART: thus CVBS and RGB. The RGB-selection is done in the HIP.
- EXT2 is meant for VCR and has therefore some additional signals in relation to EXT1 but no RGB. EXT2 has also the possibility for Y/C_in and Easylink-Plus (P50). Y_in is with pin 20 and Chroma in with pin 15. Easylink is handled via pin 10 of the SCART and this is a bi-directional communication.
- EXT3 is meant for CVBS input only.

9.6.2 Outputs

One can select three, separate switchable, outputs:
- 1 YUV-output, which is fed to the PICNIC
- 2 CVBS outputs, one for Teletext Dual Screen and the other for output to EXT2 to have WYSIWYR (What You See Is What You Record).

9.6.3 I/O Switching

The external signals are fed directly to the I/O part of the HIP with status from pin 8 of SCART. On the HIP there are two status inputs available (pins 15, 17) with two voltage levels:
- 4:3 -> 2.2 V
- 16:9 -> 5.5 V

9.6.4 P50

Easylink supports the next features:
- Signal quality and aspect ratio matching
- One touch play
- One touch text
- Pre-set download
- WYSIWYR
- Automatic Standby

With Easylink-Plus (P50+) is added:
- Country and language installation
- System Standby
- Intelligent set top box features
- NexTView download
- Timer record control
- VCR control feature

9.6.5 Video Processing

The sandcastle-pulse of the HIP is not used for synchronisation. The HOP will generate synchronisation signal derived from the feature box (PICNIC) signals. If a VCR is connected, there is also an automatic correction for MacroVision. This is active for the external sources and the pre-sets 0, 90-99.
The HIP itself (no external voltage) controls the Y/C switch in the HIP.
The chrominance decoder in the HIP is full multi-standard: PAL/SECAM/NTSC.
Two different crystals can be connected to the pins 54 & 57 without any alignment. The crystals are also used as a reference for the synchronisation. A digital control circuit that is locked to the reference signal of the colour decoder determines the start-up of the sync. The original one may only replace this crystal. If just a crystal is taken, the internal capacitance will be different and the effect will be that there is no colour.
In the HIP a sync separation circuit is integrated; the HIP delivers the HA_{50} and VA_{50} to the PICNIC.

9.7 Video: Feature Box (PICNIC and FALCONIC, diagram B3)

9.7.1 Introduction

The basic function of the Feature box (FBX6) is picture improvement, and depending on the version, several scan conversion methods are possible. The PICNIC (SAA4978H) is the central key component.
In the EM3E-chassis, the feature-box is integrated on the SSB.
The PICNIC is used for the 100Hz conversion and has the following functions:
- The ADC.
- The DAC.
- The 100 Hz conversion.
- Dual screen compression
- The Panorama mode.
- Automatic Aspect Ratio Adaptation (AARA)
- Colour Transient Improvement (CTI)
- The contrast improvement (Dynamic Contrast).

All these functions are integrated in one IC: SAA4978H, 160 pins QFP

9.7.2 ADC/DAC

Analogue to Digital conversion is done with three identical 9-bit ADC's.
Digital to Analogue conversion uses three identical 10-bit DAC's.
In the PICNIC there are three 9 bits ADCs present for Y,U,V. For digitising the Y (luminance), 9 bits are used (to realise a

more detailed picture). These 9 bits are only internally used. Via dithering the 9 bits are reduced to 8 bits and this data is stored into memory. The data in the memory is fed back to the PICNIC and via un-dithering the data is again reproduced to 9 bits for processing.
U/V (colour difference signals) is also sampled with 9 bits. These two 9 bit data streams are multiplexed to 4 bits data streams. As the perception for colours by the human eye is less sensitive as for luminance, this reduction is allowed.

9.7.3 100 Hz Conversion

The main task of the PICNIC is the conversion from 50Hz to 100Hz for YUV and HV-sync. In order to remove 'large area flicker' (especially visible in a white picture), the field-rate of the video is doubled by the FBX6. A 50/60 Hz frame frequency is converted to 100/120 Hz. Also the line frequency (16 kHz) is doubled (32 kHz).
Basically, when the video input contains fields A, B etc..., the conversion provides an AABB sequence on the display. The actual conversion is done in the first Field Memory (by reading it twice at double speed, while writing it once.

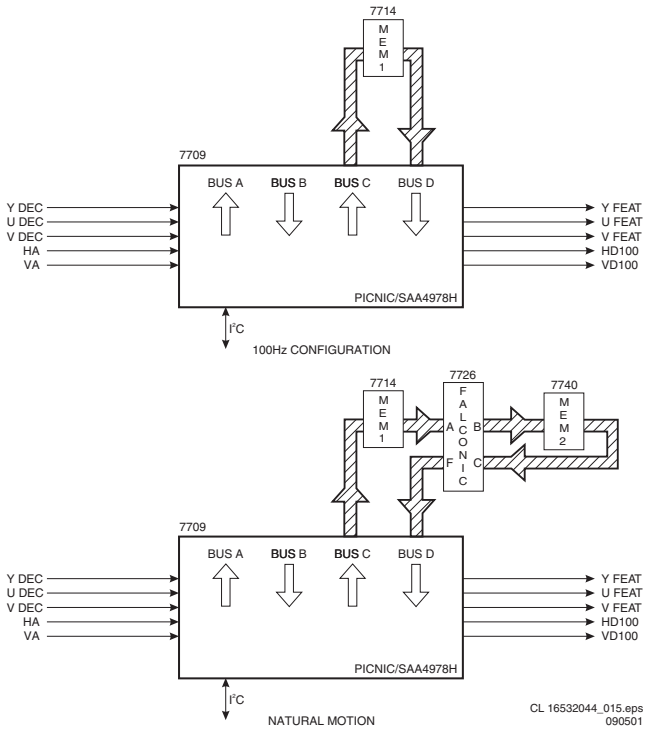


Figure 9-8

For extra 100 Hz features, it is possible to add an extra IC to the PICNIC. This IC, called the 'Field And Line CONverter IC' (FALCONIC), has three modes:

1. **100 Hz** (to eliminate field flicker). Only one memory IC (7714) is used to store one frame. It displays an AABB sequence.
2. **Digital Scan** (to additional eliminate line flicker). Together with two memory ICs (7714 and 7740), it displays an AA'BB' or ABAB sequence.
3. **Natural Motion** (to additional eliminate movement juddering).
   Together with two memory ICs (7714 and 7740), it displays an AB'A'B sequence.

9.7.4 Dual Screen Compression

The PICNIC can provide horizontal video compression up to 50 %. The compress mode can be used to display dual screens with Teletext (only for wide-screen sets).

9.7.5 The Panorama Mode

To fit 4:3 pictures into a 16:9 display, it is possible to apply a panoramic horizontal distortion, to make a screen-fitting picture without black sidebars or lost video.
The centre horizontal gain is programmable and the side gain is automatically adapted to make a screen-fit.

9.7.6 Automatic Aspect Ratio Adaptation (AARA)

This feature uses data from the 'black bar detection circuit' to adapt the vertical and horizontal amplitude to an aspect ratio belonging to the display, without the black bars.

9.7.7 Colour Transient Improvement (CTI)

At CVBS video signals, the bandwidth of colour signals is limited to 1/4 of the luminance bandwidth. Transients between areas of different colours are therefore not very sharp.
The PICNIC can steepen these transients artificially with a time manipulation algorithm.

9.7.8 Dynamic Contrast

To make the contrast (black/white) range wider, Philips has invented Dynamic Contrast. It uses the digital memory used in 100 Hz sets. It measures every A-field (25 x per second), and digitally analyses where on the greyscale most of the image is located.
If it is a relatively dark image, the lighter part of that image is stretched towards white, so that more contrast will become visible in that picture.
If it is a relatively light image, the darker part of that image is stretched towards black, so that these darker parts will have more contrast.
When the image is in the middle of the greyscale, both dark and light parts are stretched.

9.8 Video: High-end Output Processor (HOP) and TOPIC (diagram B4)

9.8.1 General

The YUV-signals from the PICNIC are fed to the HOP (High-end Output Processor, TDA9330). The video and geometry control parts are integrated in the HOP. Also the RGB-signals for TXT/OSD (from the µP), are inserted via the HOP. The geometry part delivers the H-drive, EW-drive, V-drive and also a drive signal for rotation.

The main functions of the HOP are:

- Video control (contrast, brightness, saturation, etc.).
- Deflection drive.
- 2nd RGB interface for OSD/TXT.
- Peak White Limiting.
- Cut-off control and White Drive (RGB outputs).
- Geometry control.

The TOPIC (The most Outstanding Picture improvement IC, item 7302, type TDA9178), is an **optional** IC between the PICNIC and the HOP. It has the following (picture improvement) functions:

- Luminance Transient Processor (LTP), for detail enhancement.
- Chrominance delay circuitry, to compensate timing differences between Y and C.
- Spectral processor , for improved sharpness and colour transient improvement (CTI).
- Colour vector processor, for skintone correction, green enhancement and blue stretch.
- Measure and detection circuitry, for AutoTV.

The sandcastle pulse from the HOP is fed to pin 1 of the TOPIC, which is used as reference for timing.

9.8.2 Video Control

After source selection, the HOP controls the signals for Saturation, Contrast and Brightness. Output is RGB again.

9.8.3 OSD/TXT Control

On pins 35 to 38 the RGB and fast blanking from the OTC (OSD and TXT) are inserted. The sync signal V_{SYNC}) is derived from the 'FRAMEDRIVE-" signal.

9.8.4 Peak White Limiting

On pin 43 there is a Peak White Limiting signal line (PWL). If the beam current increases, the 'EHT-info' voltage will decrease. Average limiting via R3343/C2333 controls PWL.

9.8.5 Cut-off Control

The following will happen when you switch the TV to Standby:
1. The vertical scan is completed.
2. The vertical flyback is completed (the horizontal output is gated with the flyback pulse, so that the horizontal output transistor cannot be switched 'on' during the flyback pulse).
3. The 'slow stop' of the horizontal output is started, by gradually reducing the 'on' time at the horizontal output from nominal to zero (this will take 50 ms).
4. At the same time, the fixed beam current is forced via the black-current-loop for 25 ms. This is done by setting the RGB outputs to a maximum voltage of 5.6V.

In the EM3E a **'one-point'** cut-off control is used:
A current of 8 μA (for cut-off) is fed to pin 44 of the HOP. This is done with a measurement pulse during the frame flyback. During the 1st frame, 3 pulses are generated to adjust the cut-off voltage at a current of 8 μA. With this measurement the black level at the RGB-outputs is adjusted.
So at start-up there is no monitor pulse anymore. At start-up, the HOP measures the pulses, which come back via pin 44. The RGB-outputs have to be between 1.5 V and 3.5 V. If one of the outputs is higher than 3.5 V or one of them lower then 1.5 V, the RGB-outputs will be blanked.

9.8.6 Geometry control

All geometry control is done via I^2C and the data is stored in the NVM (IC7011) of the SSB.

9.8.7 Deflection Control

Line Drive
The Line drive is derived from an internal VCO of 13.75 MHz. As a reference, an external resonator is used (1301). The internal VCO is locked with the HD_{100}-pulse, which comes from the PICNIC.
The 'PHI-2' part in the HOP receives the HFB_X-RAY_PROT (pin 13) to correct the phase of the Line drive. The EHT-info is supplied to pin 14 (DYN-PHASE-CORR) to compensate picture breathing depending on the beam current.
Note: This is not used in the EM3E, therefore EHT-compensation in the SAM menu is put to zero.

Frame Drive
At pins 1 and 2 the symmetrical frame drive signals are available. The V_{SYNC} signal, for synchronisation of the OSD/TXT, is derived from the 'FRAMEDRIVE-' signal.

East/West Drive
At pin 3, the E/W-drive is available. Pin 4 is a feedback input for the EHT-info, and is used to prevent pumping of the picture. The EHT varies also dependent on the beam current. For wide-screen without load this is 31.5 kV and with load (1.5 mA) 29.5 kV.

Frame Rotation
For frame rotation, a control voltage is used from pin 25 of the HOP. Frame rotation is only used in wide-screen sets.

9.8.8 Protections

Flash detection
When a flash occurs, the EHT-info will become negative very fast. Via R3316/D6304/D6303, TS7303 starts to conduct. This makes pin 5 of HOP 'high'. The output (pin 8) is immediately stopped.
If the H-drive stops, then also pin 5 will become 'low' again, which will reset the flash detection.
A bit (FLS) is set in an output status register, so that the OTC can see that there was a flash. This FLS-bit will be reset when the OTC has read that register.

HFB protection
If the HFB is not present, it this detected via the HOP. The OTC puts the TV into protection and reads a register in the HOP. An error code is generated.

9.9 Synchronisation (diagram B2, B3 & B4)

The HIP video processor provide the vertical and horizontal sync pulses V_A and H_A. They are synchronised with the incoming CVBS signal. Then these pulses are fed to the PICNIC, where they are doubled to be synchronous with the 100 Hz picture. The outgoing pulses, VD_{100} and HD_{100}, are fed to the HOP, which supplies the vertical and horizontal drive pulses and the 100 Hz ($2f_H$) sandcastle pulse.

The VD_{100} pulse from the PICNIC is inverted by TS7304 to the V_D signal. The OTC is synchronised on the HFB pulse from the CRT and on the V_{SYNC} from the HOP, for the synchronisation of TXT/OSD/EPG

When no CVBS is offered to the video processor, the V_{A50} and H_{A50} pulses are switched 'off' by the HIP, and the pulses are generated by the PICNIC (to assure a stable OSD).

9.10 Horizontal (Line) Deflection (diagram A3)

9.10.1 Principle

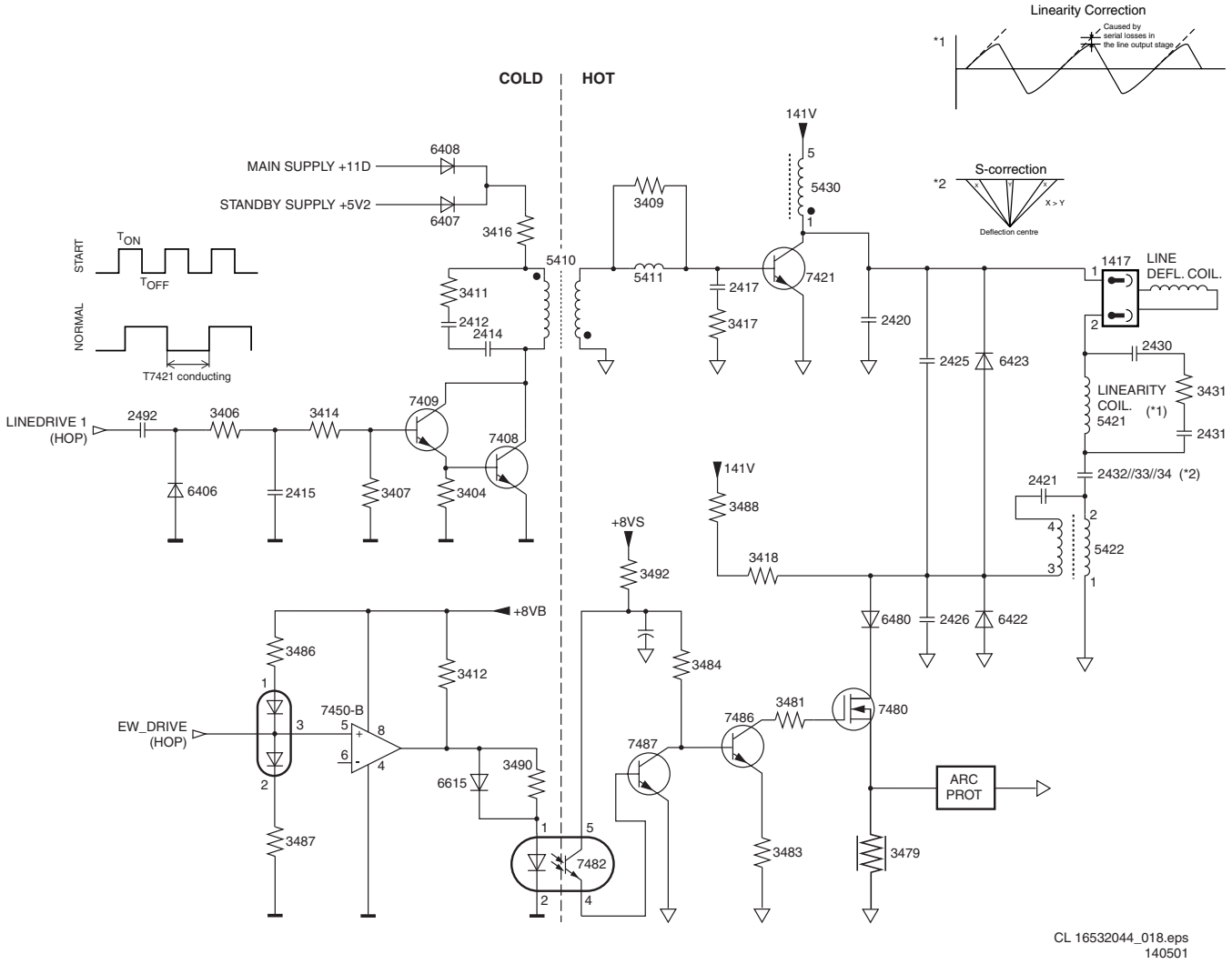


Figure 9-9

The HOP (located on the SSB) generates the line-drive pulses (LINEDRIVE1), which have a frequency of 31250 Hz (T = 32 µs).

When the LINEDRIVE1 signal is high, TS7409 and TS7408 will conduct. A constant DC voltage will be applied across L5410, causing a linear increasing current through this coil. The secondary voltage of L5410 has a negative polarity so that TS7421 will block. When the set is switched 'on', the current through L5410 is supplied by the 5V2 Standby supply (via D6407), and taken over by the +11D voltage (via D6408) of the main supply.

When the LINEDRIVE1 signal becomes low, TS7409 and TS7408 will block. The voltage polarity across the primary winding of L5410 will invert. The positive voltage on the secondary winding will now drive TS7421 into conductivity. Because of the storage time of the line transistor (TS7421), L5410 cannot transfer its energy immediately to the secondary side. This may result in high voltage peaks on the collector of TS7409 and TS7408. To prevent that these peaks will damage the transistors, a 'snubber' circuit (C2414, C2412 and R3411) will suppress them.

When the LINEDRIVE1 signal is high again, the above described sequence starts again. Circuit L5411 and R3409 will increase the switch 'off' time of the line transistor.

The line stage is started via a 'slow start' principle. During start-up, the HOP generates line drive pulses with a small T_{ON} and a high frequency (50 kHz). T_{OFF} is constant and T_{ON} is gradually increased until the frequency is 31.25 kHz (normal condition).
The time interval from start to normal condition takes about 150 ms.
When switching off, the same procedure is followed, but now in reverse order.

9.10.2 Implementation

To explain the operation of the line output stage, we use the following start conditions:

- C2433 is charged to max. 141 V (V_{BAT})
- TS7421 is driven into conductivity.

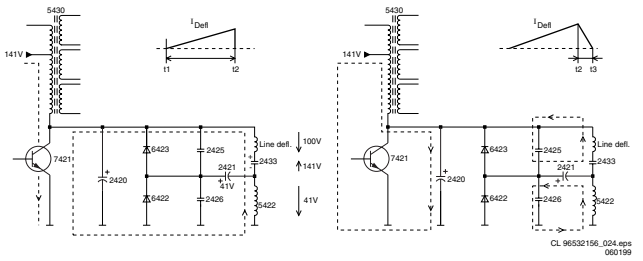


Figure 9-10

– **Period t1 - t2:** When TS7421 is driven into conductivity, the capacitor voltage of 141 V, will be divided across bridge-coil L5422 and the deflection coil (connector 0317). Due to the chosen inductance values, there will be 100 V across the deflection coil and 41 V across L5422. The linear increasing current in the deflection coil will result in a spot moving from the centre of the picture tube to the right. The voltage across L5422 will also charge C2421 (41 V - 0.7 V).
– **Period t2 - t3:** At the moment the LINEDRIVE signal becomes high, TS7421 will stop conducting. In the coils a voltage will be induced, trying to maintain the current. The current through the line deflection coils continues to flow through C2425 and C2421 and the current through L5422 continues to flow through C2426 and C2421. The energy stored in the line deflection coil is passed to C2425, and the energy of L5422 to C2426. The resonance-frequencies of these 2 LC-circuits define the flyback time of the spot from the right side of the picture tube to the left. On average no current flows through C2421 and thus the voltage across this capacitor remains constant.

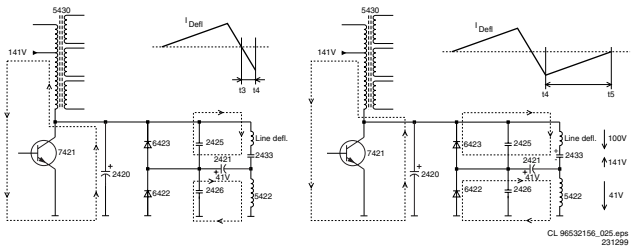


Figure 9-11

– **Period t3 - t4:** As for the period t2 - t3; but now the current flows in the opposite direction, since the voltage across C2425 and C2426 is higher than the voltage across C2433 and C2421.
– **Period t4 - t5:** The coils want to maintain the negative current and will charge the capacitors negative. Because of this, D6422 and D6423 will conduct. The voltage is 100 V across the deflection coil and 41 V across L5422. As both diodes conduct, we may consider the voltage to be constant. A linear current flows with the same changing characteristics as in period t1 - t2. The spot now moves from the extreme left of the picture tube to the centre. Before the current becomes zero, and the spot is located in the centre of the frame, TS7421 reverts back into conductivity. First a short negative current will flow. The cycle starts again.

9.10.3 Corrections

Several corrections are necessary to obtain a correct picture.

Linearity Correction
A constant voltage across the horizontal deflection coil should result in a linear increasing saw-tooth current. This is not the case however, as the resistance of the coil is not negligible. In order to compensate for this, a pre-magnetised coil L5421 in series with the deflection coil is used. This coil ensures that during time interval t1 - t3 the circuit resistance will be higher than during t4 - t5.
L5421 is called the linearity coil. To avoid self-oscillation, R3431 and C2431 are placed parallel to L5421.
See also Figure 9-9-(*1).

S-correction
Since the sides of the picture are further away from the point of deflection than the centre, a linear saw-tooth current would result in a non-linear image (the centre would be scanned slower than the sides).
To solve this, the deflection current for the right- and left side is reduced.
C2433 is charged quadratic during time interval t1 - t2. Left and right the voltage across the deflection coil decreases, causing the deflection to slow down. In the centre, the voltage increases and the deflection will be faster.
An S-shaped current is superimposed on the saw-tooth current. This correction is called ‘finger-length correction’ or ’S-Correction’.
C2433 is relatively small, as a result of which the saw-tooth current will generate a parabolic voltage with negative voltage peaks. The current also results in a parabolic voltage across C2421, resulting in the finger-length correction, proportionally increasing with the picture width.
The EW-DRIVE signal will ensure the largest picture width in the centre of the frame. Here the largest correction is applied. The larger the picture width, the higher the deflection current through C2433.
See also Figure 9-9-(*2).

E/W-correction
A line, written at the upper- or lower side of the screen, will be larger at the screen centre when a fixed deflection current is used. Therefore the amplitude of the deflection current must be increased when the spot approaches the screen centre. This is called East/West correction.

The EW drive signal originates in the HOP and is supplied to TS7480 via OpAmp 7450-B and optocoupler TS7482. The shape of this signal determines the various geometric correction parameters:
- H amplitude
- EW-parabola
- EW-corner
- EW-trapezium
- Horizontal parallelogram
- Horizontal bow

TS7480 will charge capacitor C2421 more or less, increasing the deflection current when reaching the centre of the screen. The moment TS7480 is driven into saturation, C2421 will discharge during the flyback. As a consequence of which C2421 must be charged again during the scan via the conduction diode D6422 (as long as C2421 is not charged to the voltage across L5422, D6422 will conduct).
The current in the deflection coil is therefore larger than the current flowing in L5422 (1-2). The voltage across the deflection coil increases, so the picture width increases. When TS7480 blocks, C2421 will not discharge anymore, and the voltage across C2421 will remain constant.
The result is that the voltage across the deflection coil is minimal. The voltage across coil L5422, however, is maximal. This coil (L5422) consists of a transformer with the following properties:
- As the current through the coil 1-2 increases (smaller picture width), the current through coil 3-4 decreases. Because of the transformer characteristic a higher voltage will be subjected to coil 3-4, which will counteract the current. The current will diminish even further.
- When the current through coil 1-2 diminishes (larger picture width), the current through coil 3-4 increases.

Beam-current Correction
The 'EHT-info' signal at point 10 of the LOT, depends on the value of the beam-current and the voltage from divider R3450, R3451 and C2450. This signal is fed to the HOP to trim the contrast, and to compensate for the changes in picture-width as a function of the EHT-info, when EHT is decreased. The 'EHT-info' is also used to correct the EW-current.

The 'DYN-FASE-CORR' signal, derived from the 'EHT-info' signal, is fed to the HOP via C2455 and drives a dynamic phase correction necessary because of beam-current variations. This is done by regulating T_{ON} of the line transistor TS7421.

9.10.4 Secondary Line Voltages

During the blocking time of TS7421, the magnetic energy of coil 1 - 5 of the LOT, is transferred to electrical energy in the secondary winding. Via rectifying and smoothing, the several secondary supply voltages are generated, like:
- EHT, Focus and Vg2-voltage
- +200V for the CRT panel (pin 8 LOT)
- +11D for the line deflection (pin 12 LOT)
- +13VLOT for the frame deflection (pin 6 LOT)
- -15VLOT for the frame deflection (pin 3 LOT)
- Filament voltage (pin 9 LOT)

9.11 Vertical (Frame) Deflection (diagram A4)

9.11.1 Frame Stage Drive

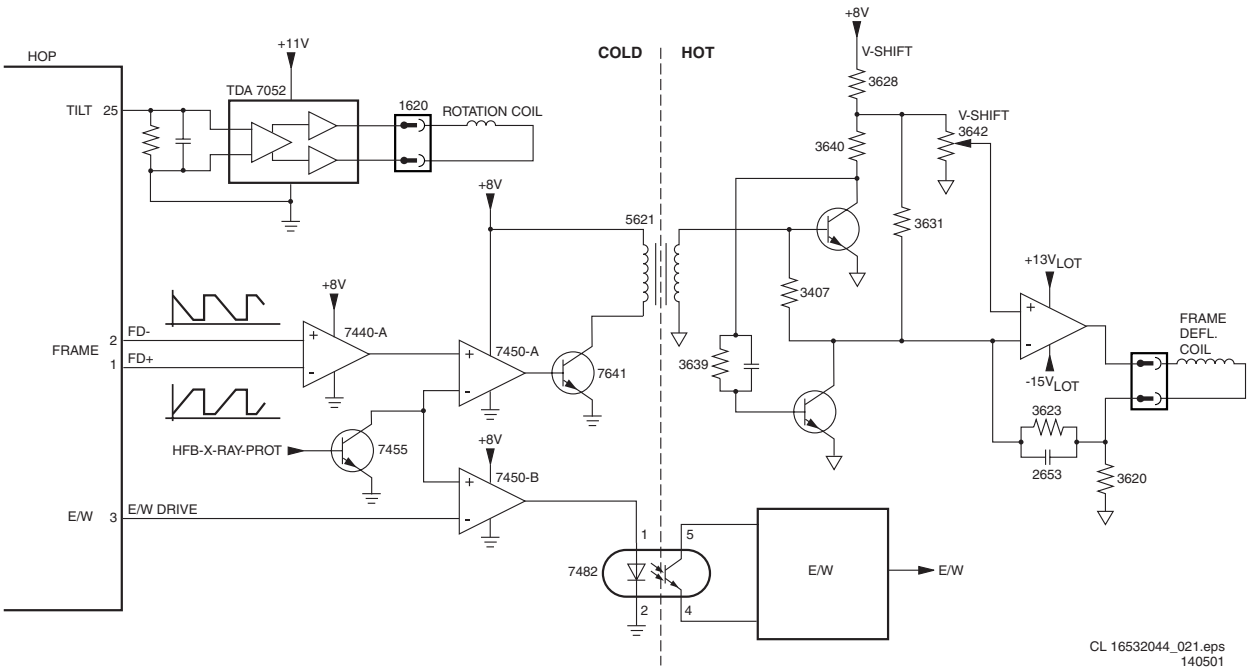


Figure 9-12

The HOP drives the frame output stage with a symmetrical saw-tooth voltage. As the HOP is 'cold' and the frame output stage is 'hot', they are galvanic isolated. This is done via a transformer (5621). As in the MG-chassis, the HOP generates 3 signals needed for the frame output stage: FRAMEDRIVE+, FRAMEDRIVE- and TILT (for rotation). The rotation circuit is kept at the 'cold' side of the chassis, to avoid the costs an extra optocoupler.
The circuit around IC7440 will amplify this signal and the output current will flow through the rotation coil.

9.11.2 Flyback Generator

The frame output stage is supplied via the +13 V and -15 V coming from the LOT. The output of the amplifier is 0 V_{DC}, so a coupling capacitor is not required.

During the (forward) scan, a supply of +13 and -15 V is sufficient to respond to the slow changing current. The internal flyback generator puts a voltage of -15 V on pin 3. Because of the voltage drop over zener diode D6622 (8.2 V), C2622 will be charged to 19 V: being 13 + (15 - 8.2 - 0.7) V. During the flyback scan, the change in current-per-time is much larger, so a higher voltage is required. The flyback generator will now generate a voltage of +13 V on pin 3. Added to the charge on C2622 this will give a flyback voltage of 32 V (depending on the CRT size, this value can differ).

The amplifier IC (IC7620, pin 5) supplies the saw-tooth current to the frame deflection coil. The current through this coil is measured via R3620//R3621//R3622 and fed back to the inverting input of the amplifier.
R3624 and C2624 on the output of the amplifier, form a filter for high frequencies and in that way also prevents oscillations.
Peak voltages on the output, e.g. as a result of a possible flash, are damped by the clamp circuit consisting of D6619, C2627 and R3627. The network consisting of R3625, R3626, R3629 and C2629 form an extra damping circuit.

9.11.3 Protection circuits

Bridge Coil Protection
The secondary voltage of the bridge coil L5422, is guarded at the diode modulator (D6421/6422) via a 10 V zener diode (6499 on diagram A3). When the bridge-coil is working properly, the average voltage on D6422 is such that this zener diode will conduct. It will drive TS7652 into saturation. When, for any reason, the secondary side of the bridge coil is shorted, the average voltage on D6422 will drop below the zener-voltage, and TS7652 will block. Now capacitor C2642 is charged. Transistor TS7407 starts conducting and the SUP-ENABLE signal is grounded via R3403. This will switch 'off' the main supply (see diagram A1).

Frame Output Protection

Via the circuit built around TS7641 the frame output stage is guarded. If the frame output stage is working properly, TS7641 and TS7652 will both conduct and thereby discharge C2642. TS7407 is blocked, so the SUP-ENABLE signal is 'high'.
If there are frame pulses missing, TS7641 will block and capacitor C2642 is charged. Transistor TS7407 starts conducting and the SUP-ENABLE signal is grounded via R3403. This will switch 'off' the main supply (see diagram A1).

ARC Protection

If there are 'open' connections (e.g. bad solder joints) in the *high energy* deflection circuitry, this can lead to damaging effects (read: fire). For that reason, the E/W current is sensed (via 3479//3480). If this current becomes too high, the 'thyristor' circuit (TS7653 and TS7654) is triggered. TS7442 is switched 'on' and TS7443 is forced into conduction. . The 'SUP-ENABLE' signal is shorted now to ground level, which will force the Main Power Supply to Standby mode

9.12 Audio (diagram B6, A6 & A7)

9.12.1 Introduction

All EM3E sets contain one of ITT's Multi-standard Sound Processing (MSP) ICs for sound decoding. The diversity arises because each member of the MSP-family handles its own set of sound standards:

- MSP3411: Virtual Dolby decoding.
- MSP3412: Dolby ProLogic decoding.

Both versions also handle NICAM.

The MSP IC takes care of the main FM sound decoding. AM decoding for the L system is done by the HIP. The demodulated L sound is then again source selected and processed in the MSP. The reason for this is the bad AM detection performance of the MSP. However in case of NICAM L, it is handled by the MSP.

All MSP versions contain digital audio processing, used for the basic left/right stereo sound, such as bass, treble, balance, incredible sound and spatial.
In addition to that, both versions are capable of Dolby processing:

- The MSP3411can perform 'Virtual Dolby' processing (a Dolby approved sound mode for surround sound reproduction with left/right speakers only).

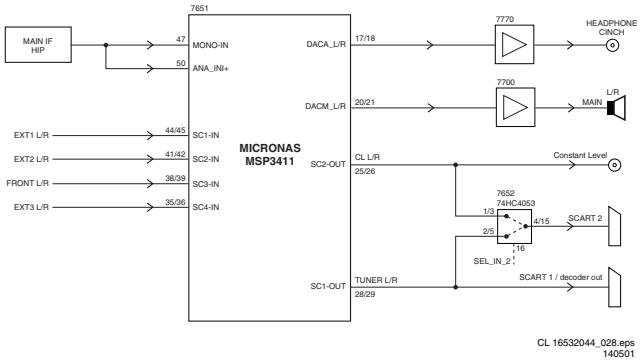


Figure 9-13

- The MSP3412 can perform 'Dolby ProLogic' processing (left, right and (mono) surround).

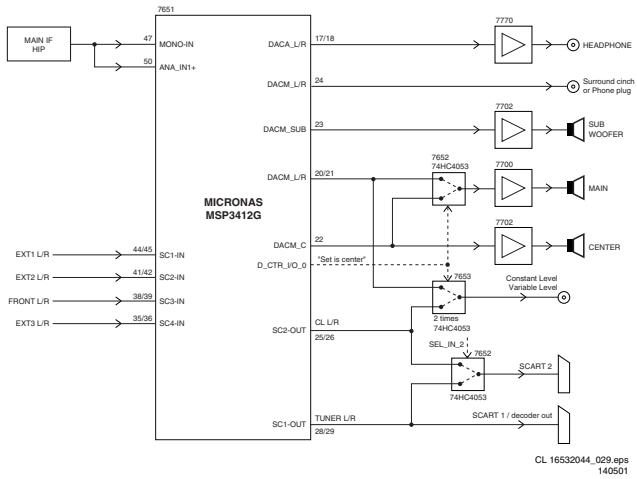


Figure 9-14

Following amplifier configurations are possible:

- Virtual Dolby, L/R, 2 x 15 W (88XX-series)
- 3D Surround, L/R, Centre, Subwoofer, 4 x 15 W (95XX-series).

9.12.2 Inputs / Outputs

Both versions can cover 4 stereo **inputs** and one AM (mono) input. This means in practice: 3 SCART inputs, 1 side input and 1 AM (mono) input.

Both versions have the following **outputs**: SCART1 (CVBS/ decoder out), SCART2 (record select/WYSIWYR out) and headphone.

9.12.3 Source Selection

The constant level output to SCART2 is connected via a so-called 'Régimbeau' switch (IC7652) (see also Figure 9-13). This switch is needed to prevent acoustic feedback (Larsen effect). This effect is caused, when EXT2 is chosen as input signal, and the output of SCART2 is selected. This means that the main picture is also EXT2, which will cause the Larsen effect.
To prevent this, the record select must be switched to 'Tuner'. This is especially important when decoders are used, behind a 'transparent' VCR connected to EXT2.

To get a constant level output if the Tuner is selected, the SCART1 output ('Tuner' at any time), has to be fed back to the input selector and selected as input for the MSP (SCART1 input).

The MSP34XX has a separate headphone output, so sound control be done separate from the speakers.

9.12.4 Audio Decoding

At the input a choice can be made between two IF-signals; SIF and SIFM.
The selected signal is fed to the AGC. After this, an ADC converts the IF-signal to digital.
Two demodulation channels can process this digital signal. The first one is able to handle FM and NICAM signals. The second one can handle FM and AM signals.
Each channel contains a mixer to shift the incoming signal in the frequency domain. This shift is determined by the value of a DCO.
After the down-mix, the signal is fed, via a filter, to a discriminator. From here the AM, FM or NICAM demodulation can be performed.

Both channels contain an 'automatic carrier mute' function, which automatically mutes the output of the analogue section when no carrier is detected.
After demodulation, the FM-signals are subjected to a de-emphasis operation. After that the matrix of the stereo system is applied.

9.12.5 Audio Processing

The sound processing in EM3E is completely done by the MSP's:

- Volume control is done by the user via the SOUND menu.
- Tone control in 'Stereo' sets is done via the BASS/ TREBLE control, in 'Virtual Dolby' sets via the 5-band equaliser.
- Headphone control, the MSP has a separate Headphone output so separate sound control is possible.

Automatic Volume Levelling (AVL)
One of the features of the MSP-family is Automatic Volume Limiting (AVL). If used, it limits the big volume differences in the broadcast between e.g. news transmissions and commercials, or within a movie.
To be able to get a Dolby approval (for the Virtual Dolby sets), the AVL feature must be switchable. Therefore, the AVL feature is customer switchable via the menu.

9.12.6 Audio Amplifier (diagram A6)

The audio amplifier is an integrated 'class-D' power amplifier IC, the TDA7490. It delivers an output of 2 x 15 WRMS to 2 full range speakers. For the higher specified sets, a subwoofer and centre speaker are easy to implement, by adding a second amplifier.

Principle
Audio-power-amplifier systems have traditionally used linear amplifiers, which are well known for being inefficient. In fact, a linear Class AB amplifier is designed to act as a variable resistor network between the power supply and the load. The transistors operate in their linear region and the voltage that is dropped across the transistors (in their role as variable resistors) is lost as heat, particularly in the output transistors. Class D amplifiers were developed as a way to increase the efficiency of audio-power-amplifier systems.

The Class D amplifier works by varying the duty cycle of a Pulse Width Modulated (PWM) signal.
By comparing the input voltage to a triangle wave, the amplifier increases duty cycle to increase output voltage, and decreases duty cycle to decrease output voltage.
The output transistors of a Class D amplifier switch from full 'off' to full 'on' (saturated) and then back again, spending very little time in the linear region in between. Therefore, very little power is lost to heat.
If the transistors have a low 'on' resistance $R_{DS(ON)}$, little voltage is dropped across them, further reducing losses.

The advantage of Class D is increased efficiency (= less heat dissipation). Class D amplifiers can drive the same output power as a Class AB amplifier using less supply current.
The disadvantage is the large output filter that drives up cost and size. The main reason for this filter, is that the switching waveform results in maximum current flow. This causes more loss in the load, which causes lower efficiency.
An LC filter with a cutoff frequency less than the Class D switching frequency (200 kHz), allows the switching current to flow through the filter instead of the load. The filter is less lossy than the speaker, which causes less power dissipated at high output power and increases efficiency in most cases.

The supply voltage is a symmetrical voltage of +/- 16 V (or +/ - 19 V depending on the set execution), generated by the main supply via L5512 (or L5506).

Mute
Sound-mute is done via the STBY-MUTE line connected to pin 6 (tri-state input) of the amplifier IC. This line is activated via the SOUND-ENABLE line (software controlled) and/or POR line (hardware controlled).
This signal is inverted by TS7701 and/or TS7703, as a result of which at a high level of the SOUND-ENABLE signal, current is sinked from pin 2 and the IC mutes.

Protection
A loudspeaker DC protection is implemented. The amplifier IC TDA7490 has a 'standby-mute-play' feature via the tri-state input pin 6. When the voltage on pin 6 is:

- 0 - 0.7 V, the IC is in 'standby' mode
- 1.7 - 2.5 V, the IC is in 'mute' mode
- 4 - 5 V, the IC is in 'play' mode (normal operation).

Note: this is a 'local' protection, **not** known to the microprocessor.

This works as follows:

- During normal operation, V_X is 'low' (0 V) and V_Y is 'high' (+5 V).
- When a **positive** DC-voltage is detected on a loudspeaker output (= V_X), TS7704, TS7706 and TS7707 will conduct, making V_Y 'low'.
- When a **negative** DC-voltage is detected on a loudspeaker output (= V_X), TS7705, TS7706 and TS7707 will conduct, making V_Y also 'low'.

When V_Y is 'low' (read 0 V), the tri-state input (pin 6) puts the amplifier IC in 'standby' mode.

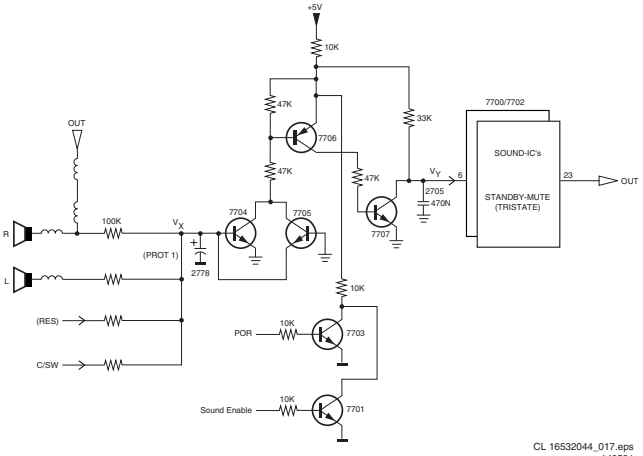


Figure 9-15

9.12.7 Headphone Amplifier (diagram A7)

The headphone amplifier is a straight forward OpAmp amplifier (7770, NJM4556). It is supplied with +/- 16 V.

9.13 Teletext and NexTView

9.13.1 Teletext

The TXT-decoder in the OTC gets its video signal directly on pin 5 (from the HIP).
The RGB-outputs are available on pins 77/78/79. Fast blanking is realised via pen 80.
The DRAM (IC7007) of the microprocessor is used for storage of the TXT pages.

9.13.2 NexTView

NexTView allows the user to display a program guide on the TV screen, that contains extensive information for each program (only when supported by the programs provider).

This information can be displayed in a number of different summaries:

- DAY: The daily summary shows, from the current moment, the program schedule for several stations for a short time ahead.
- CHANNEL: The channel summary shows the program schedule for one station.
- THEME: The theme summary shows, for each theme, the program schedule of the various stations. These themes consist of sport, film, culture, etc. and is determined from the station side.

NexTView does not have to restrict itself to information about the station that is being viewed, but also offers information about other stations. In the various summaries 3 different commands can be given for the various program overviews. These commands appear as follows:

- WATCH: The set immediately switches over to the station concerned.
- REMINDER: The start time and date and the station of the program concerned is stored in the TV reminder list. The TV will give an OSD-message with the program information, or switch on the set at the correct moment (provided the set is in Standby) and tune to the station concerned.
- RECORD: The timer of the video recorder with ‘Easylink Plus’ is programmed with the data of the program concerned. There has to be a video recorder (with Easylink Plus) connected to SCART2 otherwise the ‘RECORD’ function will not be highlighted. The connection is via pin 10 from SCART. This means that it has to be a full SCART or at least pin 10 has to be wired.

In order to be able to realise NexTView, two teletext type data flows, Data stream 1 and 2, are transmitted with various sub-code pages of information. This data flow can transport limited information (max. 40 pages). Data stream 1 is quick repeating with a repetition time of approximately 20 to 30 seconds. However, Data stream 2 has a much longer repetition time of approximately half an hour and has a large transport capacity.

- Data stream 1 contains information of the station that is being viewed.
- Data stream 2 contains up to one week of advance information from various stations that are covered by the provider.

9.14 CRT / SCAVEM / Rotation (diagram F)

9.14.1 RGB Amplifiers

On the CRT panel, the RGB amplifier (TDA6108, IC7307) is located. Via the outputs 7, 8 and 9 the cathodes of the picture tube are driven.
The supply voltage for the amplifier is 200 V and is derived from the LOT.

9.14.2 SCAVEM

The SCAn VElocity Modulation (SCAVEM) circuitry is implemented in the layout of the picture tube panel. It is thus not an extra module. This circuit influences the horizontal deflection as a function of the picture content. In an ideal square wave, the sides are limited in slope due to a limited bandwidth (5 MHz).

Principle
SCAVEM will improve the slope as follows:
At a positive slope, a SCAVEM current is generated which supports the deflection current. At the first half of the slope, the spot is accelerated and the picture is darker. At the second half of the slope, the spot is delayed and the slope becomes steeper.
At the end of the slope, the SCAVEM-current decays to zero and the spot is at the original position. An overshoot occurs which improves the impression of sharpness.
At the negative slope, the SCAVEM-current counteracts the deflection. During the first half of the slope, the spot is delayed, the slope becomes steeper. During the second half the spot accelerates, the SCAVEM-current is zero at the end of the slope.

Implementation
Via the three resistors R33358, R33359 and R3360, Red, Green and Blue are added together, buffered and offered to the emitter of TS7300. On the collector of this transistor, configured in a common base, the sum of these 3 signals is obtained. Via the emitter follower formed with TS7301, this signal is conveyed to the differentiator C2330, R3324 and R3318. Only the high frequencies are differentiated (small RC-time).
The positive and negative pulses of this signal drive respectively TS7303 and TS7302 into conductivity. The DC setting of the output stage is set by R3304, R3308, R3316 and R3319. The working voltage of the transistors is settled at half the supply voltage.
At the positive section of the pulse, the current flows through R3318, C2307, the SCAVEM-coil and TS7303. At the negative section of the pulse, the current flows through R3318, C2309, the SCAVEM-coil and TS7302.

9.14.3 Rotation

In sets with a rotation coil (wide screen sets), the amount of frame rotation is adjusted with the DAC-output of the HOP (see also 'Vertical Deflection').

9.15 Software Related Features

Following features are described:

- Auto TV
- ‘Switch On’ Behaviour

9.15.1 AutoTV

The AutoTV (or 'Automatic Picture Control' or 'Active Control') aims at giving the customer the best possible picture performance at any time. Therefor it does real time processing of the video signal and as a result, it decides to adapt several video parameters throughout the whole chassis.

The AutoTV feature integrates traditional picture performance, AutoTV functionality and 'smart controls' in order to come to a kind of 'super smart' TV. It can be subdivided in:

- **Auto Noise Reduction.** This algorithm measures the amount of noise in the incoming video signal (this is done by the LIMERIC part of the PICNIC). As a result of this measurement, the amount of noise in the picture is corrected, starting from that noise level which is annoying for the customer. Which parameters exactly can be used is depending on the hardware.
- **Auto Sharpness.** This algorithm measures the amount of sharpness via the bandwidth of the incoming video signal and adapts the peaking frequency in the PICNIC according to this info. If the 'sharpness meter' sees the video content as 'sharp', high frequency peaking will be used. On the other hand, if the picture content is seen as

'not sharp', a low/mid frequency peaking is used. There is a coupling between the Auto Noise and the Auto Sharpness algorithm: if noise is present in the video content, then in general the sharpness will be made less aggressive. Special care has to be taken to the interaction of the LIMERIC and the vertical peaking of the PICNIC: a too big amount of vertical peaking increases the visibility of the 2DNR artefacts.

9.15.2 'Switch On' Behaviour

Below find the start-up sequence:

1. After the power is applied, the 'Standby supply' starts oscillating, generating the +5V2 (and +3V3). A RESET is generated and the OTC is awakened.
2. Next step is the check whether the set needs to be in 'Standby' mode or not. Therefore, the NVM content is read and the Standby-bit is checked. If the set is to stay in Standby, there is no further action.
3. If the set will switches 'on', first the degaussing will be activated (12 seconds). Meanwhile the MSP is reset and the Standby line is pulled low, leading to a full semi standby mode (5 V and 8V switched on)
4. The OTC waits until the +5V and the +8 V are fully present. This is done by checking the AD-input of the OTC. The +5V, +8V and I^2C protection-algoritms are activated.
5. The HOP is instructed via the I^2C-bus to start the drive. Via the SUP-ENABLE signal, the main supply is activated. The Line Deflection circuitry is supplied now with the V_{BAT}, and the EHT generation can start.
6. During start-up of the deflection, I^2C traffic must be disabled for 250 ms to avoid data corruption. If flashes or spikes are generated during EHT start-up, I^2C data could be disturbed or corrupted.
7. After deflection is powered up completely, all the other protection-algorithms are activated. The black current stabilisation loop in the HOP is switched on. Some extra checking is done to ensure that the loops are completely stabilised. The OTC sets all the necessary parameters for a correct sound and image and unblanks the picture.

9.16 Abbreviation List

AARA	Automatic Aspect Ratio Adaptation: algorithm that adapts aspect ratio to remove horizontal black bars; keeping up the original aspect ratio
ACI	Automatic Channel Installation: algorithm that installs TV sets directly from cable network by means of a predefined TXT page
ADC	Analogue Digital Converter
AFC	Automatic Frequency Control: control signal used to tune to the correct frequency
AGC	Automatic Gain Control: algorithm that controls the video input of the feature-box
AM	Amplitude Modulation
ANR	Automatic Noise Reduction: one of the algorithms of Auto TV
AR	Aspect Ratio: 4 by 3 or 16 by 9
Artistic	see OTC 2.5: main processor
ASF	Auto Screen Fit: algorithm that adapts aspect ratio to remove horizontal black bars but without throwing away video information
ATV	See Auto TV
AUDIO_C	Audio Centre
AUDIO_L	Audio Left
AUDIO_R	Audio Right
AUDIO_SL	Audio Surround Left
AUDIO-SR	Audio surround right
AUDIO_SW	Audio Subwoofer
Auto TV	Name for the combination of picture features/improvements which work automatically (ANR / Auto sharpness/Auto Histo/ambient light).
BG	System B and G
B-SC1-IN	Blue SCART1 in
B-SC2-IN	Blue SCART2 in
B-TXT	Blue teletext
CL	Constant Level: audio output to connect with an external amplifier
ComPair	Computer aided rePair
CRT	Cathode Ray Tube or picture tube
CSM	Customer Service Mode
CTI	Colour Transient Improvement: manipulates steepness of chroma transients
CVBS	Composite Video Blanking and Synchronisation
CVBS-TER	CVBS terrestrial
DAC	Digital to Analogue Converter
DBE	Dynamic Bass Enhancement: extra low frequency amplification
DC-filament	Filament supply voltage
DFU	Direction For Use: description for the end user
DNR	Digital Noise Reduction: noise reduction feature of the box
DSP	Digital Signal Processing
DST	Dealer Service Tool: special remote control designed for dealers to enter e.g. service mode
DVD	Digital Versatile Disc
DYN-FASE-COR	Dynamic phase correction
EHT	Extra High Tension
EHT-INFO	Extra High Tension information
EPG	Electronic Program Guide: system used by broadcasters to transmit TV guide information (= NexTView)
EW	East West, related to horizontal deflection of the set

EXT	External (source), entering the set via SCART or via cinches
FBL	Fast Blanking: DC signal accompanying RGB signals
FBX	Feature Box: part of small signal / separate module which contains 100 Hz processing, extra featuring and AutoTV algorithms
FILAMENT	Filament of CRT
FLASH	Flash memory
FM	Field Memory or Frequency Modulation
G-TXT	Green teletext
HA50	Horizontal Acquisition 1fh: horizontal sync pulse coming out of the HIP
HD100	Horizontal Drive 2fh: horizontal sync pulse coming out of the feature-box
HFB	Horizontal Flyback Pulse: horizontal sync pulse from large signal deflection
HIP	High-end video Input Processor: video and chroma decoder of EM3E
HOP	High-end video Output Processor: video, sync and geometry controller of EM3E
HP	Headphone
Interlaced	Scan mode where two fields are used to form one frame. Each field contains half the number of the total amount of lines. The fields are written in 'pairs', causing line flicker.
Last Status	The settings last chosen by the customer and read and stored in RAM or in the NVM. They are called at start-up of the set to configure it according the customers wishes
LDP	Line Deflection Protection
LED	Light Emitting Diode
LINE-DRIVE	Line drive signal
LNA	Low Noise Adapter
LSP	Large signal panel
MSP	Multi-standard Sound Processor: ITT sound decoder of EM3E
MUTE	Mute-Line
NC	Not Connected
NVM	Non Volatile Memory: IC containing TV related data e.g. alignments
O/C	Open Circuit
ON/OFF LED	On/Off control signal for the LED
OSD	On Screen Display
OTC	On screen display Teletext and Control; also named Artistic (SAA5800)
P50	Project 50 communication: protocol between TV and peripherals
PCB	Printed Circuit board
PICNIC	Peripheral Integrated Combined Network IC: main IC for 100 Hz featuring and feature processing
Progressive Scan	Scan mode where all scan lines are displayed in one frame at the same time, creating a double vertical resolution.
PTP	Picture Tube Panel
RAM	Random Access Memory
R-TXT	Red teletext
RC	Remote Control
RC5 / RC6	Signal protocol from the remote control receiver
RESET	Reset signal
ROM	Read Only Memory
SAM	Service Alignment Mode
SC	Sandcastle: pulse derived from sync signals
SCAVEM	Scan Velocity Modulation
S/C	Short Circuit
SIF	Sound Intermediate Frequency
SIMM	80-fold connector between LSP and SSB
SNERT	Synchronous No parity Eight bit Reception and Transmit
SSB	Small Signal Board
STBY	Standby
SW	Subwoofer
TXT	Teletext
TXT DS	Teletext Dual Screen
µP	Microprocessor
U100	U from Feature Box
V100	V from Feature Box
VA50	Vertical Acquisition 1Fh
VBAT	Main supply for deflection (mostly 141 V)
VD100	Vertical Drive 2fh: vertical sync pulse from deflection
VFB	Vertical Flyback Pulse: vertical sync pulse coming from the feature box
VL	Variable Level out: processed audio output towards external amplifier
WYSIWYR	What You See Is What You Record: record selection that follows main picture and sound
XTAL	Quartz crystal
Y100	Y from Feature Box
Y-OUT	Luminance-signal to HOP IC

10. Spare Parts List

Large Signal Panel [A]

Various

0010	2422 025 16374	2P Male
0020	4822 267 10774	2P Male
0032	4822 492 70788	IC-SPRING
0037	3104 304 21112	LOT SSB SUPPORT
0045	4822 267 10734	5P MALE
0065	3104 304 22031	LOT SPACER
0066	3104 304 21591	SCART SUPPORT BRACKET
0150	4822 265 11253	FUSE HOLDER
0153	4822 265 11253	FUSE HOLDER
0317	4822 265 20723	2P MALE
0324	3104 311 01881	CABLE 7P 480mm
0325	2422 025 16382	3P Male
0735	2422 025 16407	3P Male
0736	2422 025 16382	3P Male
0936	2422 025 12485	11P Male
0940	4822 267 10968	11P FEMALE
0943	4822 267 10748	3P MALE
0945	4822 267 10735	3P MALE
0946	5322 268 90415	2P MALE
0947	4822 267 10734	5P MALE
1001	4822 252 60151	SURGE PROTECT
1002	2422 132 07411	RELAY 1P 5V 5A
1003	4822 267 10973	1P
1200	4822 210 10848	UV1316/A I U-2
1205	2422 025 16599	80P Female SIMM
1501	4822 070 34002	FUSE 4A
1503	2422 086 10912	FUSE 2,5A
1901	4822 267 10771	IC SOCKET 42P
1902	4822 267 10982	2P
8000	4822 320 12525	CABLE
8001	4822 320 20234	EHT CABLE
8015	4822 320 20216	CABLE
	3122 785 100	Supply Kit Mains Supply EM2E
	3122 785 100	Supply Kit Standby Supply EM2E
	3122 785 100	Line Repair Kit EM2E

⊣⊢

2101	5322 122 32818	2.2nF 10% 100V
2102	4822 124 40248	10µF 20% 63V
2103	5322 122 32531	100pF 5% 50V
2104	4822 123 14025	2200µF 20% 16V
2105	5322 122 32531	100pF 5% 50V
2106	5322 126 10223	4.7nF 10% 63V
2107	5322 122 32818	2.2nF 10% 100V
2108	4822 121 70162	10nF 5% 400V
2109	4822 126 13482	470nF 80/20% 16V
2110	5322 121 42498	680nF 5% 63V
2111	4822 121 43526	47nF 5% 250V
2113	4822 122 33127	2.2nF 10% 63V
2114	4822 126 10206	2.2nF 10% 500V
2200	4822 124 40196	220µF 20% 16V
2201	4822 126 14076	220nF 25V
2202	4822 126 13473	220nF 80-20% 50V
2203	4822 124 41584	100µF 20% 10V
2400	4822 124 11575	47µF 20% 160V
2412	4822 126 13751	47nF 10% 63V
2413	4822 124 12255	10µF 20% 50V
2414	4822 126 13751	47nF 10% 63V
2415	4822 122 33575	220pF 5% 63V
2417	4822 126 14076	220nF 25V
2419	4822 126 14237	470pF 10% 2KV
2420	4822 121 70594	1nF 5% 2KV
2421	2022 333 00086	470nF 5% 250V
2421	4822 121 42634	560nF 5% 250V
2425	4822 121 10526	9N1 5% 2KV
2425	4822 121 70435	10nF 5% 2KV
2426	4822 121 10653	22nF 5% 630V
2426	4822 121 10658	24nF 5% 630V
2429	4822 121 43343	4.7nF 10% 400V
2430	4822 121 41857	10nF 5% 250V
2431	4822 121 42077	6.8nF 10% 400V
2431	4822 126 13599	3.3nF 10% 500V
2433	2022 333 00086	470nF 5% 250V
2433	4822 121 42634	560nF 5% 250V
2435	4822 121 10526	9N1 5% 2KV
2450	5322 121 42578	100nF 5% 250V
2455	5322 126 10511	1nF 5% 50V
2460	4822 124 40784	3300µF 20% 16V
2461	4822 122 31177	470pF 10% 500V
2462	4822 124 80061	1000µF 20% 25V
2463	4822 122 31177	470pF 10% 500V
2464	4822 124 80061	1000µF 20% 25V
2465	4822 122 31177	470pF 10% 500V
2468	4822 124 12297	4.7µF 20% 350V
2469	4822 122 31177	470pF 10% 500V
2480	4822 121 51442	2.2nF 10% 50V
2489	4822 124 40433	47µF 20% 25V
2490	4822 122 33891	3.3nF 10% 63V
2491	4822 124 40768	0.47µF 20% 100V
2492	4822 126 14076	220nF 25V
2495	4822 126 13838	100nF 20% 50V
2499	4822 126 13838	100nF 20% 50V
2501	4822 126 11524	1.5nF 10% 1KV
2502	5322 122 32818	2.2nF 10% 100V
2503	5322 121 42489	33nF 5% 250V
2505	4822 126 14504	3.3nF 20% 250V
2507	4822 126 13589	470nF 275V
2508	4822 126 14153	2.2nF 10%B 1KV
2509	4822 126 14153	2.2nF 10%B 1KV
2510	4822 124 12415	220µF 20% 400V
2512	4822 124 12056	1000µF 20% 35V
2513	5322 122 34099	470pF 10% 63V
2514	5322 122 31863	63V 330pF 5%
2515	4822 124 11575	47µF 20% 160V
2518	4822 126 11308	47pF 5% 500V
2519	5322 122 32818	2.2nF 10% 100V
2520	4822 126 14585	100nF 10% 50V
2521	4822 122 33216	270pF 5% 50V
2528	4822 126 14585	100nF 10% 50V
2530	4822 126 14585	100nF 10% 50V
2531	4822 122 31169	1.5nF 10% 500V
2535	4822 121 43913	470nF 10% 100V
2536	4822 126 10206	2.2nF 10% 500V
2537	4822 124 11913	22nF 20% 275V
2538	5322 126 10223	4.7nF 10% 63V
2600	4822 121 43913	470nF 10% 100V
2601	4822 121 51252	470nF 5% 63V
2602	4822 124 40433	47µF 20% 25V
2603	4822 122 33177	10nF 20% 50V
2604	4822 124 40248	10µF 20% 63V
2610	4822 122 33127	2.2nF 10% 63V
2620	4822 126 14076	220nF 25V
2621	4822 126 13838	100nF 20% 50V
2622	4822 124 40255	100µF 20% 63V
2624	4822 121 51252	470nF 5% 63V
2625	4822 121 51252	470nF 5% 63V
2627	5322 124 40641	10µF 20% 100V
2642	4822 124 40255	100µF 20% 63V
2700	4822 124 21913	1µF 20% 63V
2701	4822 124 21913	1µF 20% 63V
2730	4822 124 81151	22µF 50V
2731	4822 124 81151	22µF 50V
2732	4822 124 40255	100µF 20% 63V
2733	4822 124 40255	100µF 20% 63V
2734	4822 124 81151	22µF 50V
2735	4822 124 81151	22µF 50V
2736	5322 122 31865	1.5nF 10% 63V
2737	5322 122 31865	1.5nF 10% 63V
2756	4822 126 13751	47nF 10% 63V
2760	4822 124 80061	1000µF 20% 25V
2761	4822 124 80061	1000µF 20% 25V
2765	4822 124 40255	100µF 20% 63V
2767	4822 124 40255	100µF 20% 63V
2782	4822 126 13751	47nF 10% 63V
2902	5322 122 31863	330pF 5% 63V
2903	5322 122 31863	330pF 5% 63V
2906	5322 122 32531	100pF 5% 50V
2909	5322 122 31863	330pF 5% 63V
2910	5322 122 32531	100pF 5% 50V
2912	4822 124 40248	10µF 20% 63V
2913	4822 126 14585	100nF 10% 50V
2915	5322 122 31863	330pF 5% 63V
2916	5322 122 31863	330pF 5% 63V
2917	5322 122 32531	100pF 5% 50V
2919	5322 122 31863	330pF 5% 63V
2920	5322 122 32531	100pF 5% 50V
2923	5322 122 31863	330pF 5% 63V
2925	5322 122 31863	330pF 5% 63V
2926	4822 124 81044	470µF 20% 6.3V
2927	4822 124 40433	47µF 20% 25V
2941	5322 122 31865	1.5nF 10% 63V
2942	5322 122 31865	1.5nF 10% 63V
2951	4822 124 21913	1µF 20% 63V
2952	4822 126 13751	47nF 10% 63V
2953	4822 126 13751	47nF 10% 63V

⊣▭

3101	4822 053 20106	10M 5% 0.25W
3102	4822 050 26801	680Ω 1% 0.6W
3103	4822 050 26801	680Ω 1% 0.6W
3104	4822 116 52195	47Ω 5% 0.5W
3105	4822 050 26801	680Ω 1% 0.6W
3106	4822 116 52256	2k2 5% 0.5W
3107	4822 116 52256	2k2 5% 0.5W
3108	4822 116 52182	15Ω 5% 0.5W
3110	4822 052 10109	10Ω 5% 0.33W
3113	4822 116 52182	15Ω 5% 0.5W
3114	4822 116 83872	220Ω 5% 0.5W
3117	4822 116 52195	47Ω 5% 0.5W
3118	4822 050 24708	4Ω7 1% 0.6W
3120	4822 051 20109	10Ω 5% 0.1W
3123	4822 116 52176	10Ω 5% 0.5W
3124	4822 116 52199	68Ω 5% 0.5W
3125	4822 116 52182	15Ω 5% 0.5W
3126	4822 050 21003	10k 1% 0.6W
3127	4822 116 52289	5k6 5% 0.5W
3200	4822 051 20101	100Ω 5% 0.1W
3201	4822 051 20101	100Ω 5% 0.1W
3250	4822 051 20223	22k 5% 0.1W
3402	4822 117 10837	100k 1% 0.1W
3403	4822 051 20101	100Ω 5% 0.1W
3404	4822 051 20471	470Ω 5% 0.1W
3406	4822 051 20101	100Ω 5% 0.1W
3407	4822 117 10833	10k 1% 0.1W
3410	4822 051 20479	47Ω 5% 0.1W
3411	4822 116 52193	39Ω 5% 0.5W
3414	4822 117 13577	330Ω 1% 1.25W
3415	3198 012 31590	15Ω 5% 3W
3415	4822 117 12836	12Ω 5% 3W
3417	4822 116 52176	10Ω 5% 0.5W
3418	4822 050 22704	270k 1% 0.6W
3431	4822 052 10101	100Ω 5% 0.33W
3431	4822 052 10221	220Ω 5% 0.33W
3450	4822 116 52303	8k2 5% 0.5W
3450	4822 116 83961	6k8 5%
3451	4822 116 52257	22k 5% 0.5W
3460	4822 052 10108	1Ω 5% 0.33W
3461	4822 052 10108	1Ω 5% 0.33W
3462	4822 052 10108	1Ω 5% 0.33W
3463	4822 052 10108	1Ω 5% 0.33W
3464	4822 052 10108	1Ω 5% 0.33W
3465	4822 052 10108	1Ω 5% 0.33W
3466	4822 052 10688	6Ω8 5% 0.33W
3466	4822 052 10828	8Ω2 5% 0.33W
3467	4822 052 10108	1Ω 5% 0.33W
3468	4822 052 11688	6Ω8 5% 0.5W
3475	4822 116 52175	100Ω 5% 0.5W
3481	4822 116 52175	100Ω 5% 0.5W
3483	4822 051 10102	1k 2% 0.25W
3484	4822 117 11139	1k5 1% 0.1W
3485	4822 117 11454	820Ω 1% 0.1W
3486	4822 117 12955	2k7 1% 0.1W
3487	4822 117 11449	2k2 1% 0.1W
3488	4822 116 52272	330k 5% 0.5W
3488	4822 116 83874	220k 5% 0.5W
3489	4822 117 11449	2k2 1% 0.1W
3491	4822 050 21504	150k 1% 0.6W
3495	4822 051 20683	68k 5% 0.1W
3496	4822 117 11507	6k8 1% 0.1W
3497	4822 117 10834	47k 1% 0.1W
3498	4822 051 20472	4k7 5% 0.1W
3499	4822 117 10837	100k 1% 0.1W
3500	4822 117 12074	1Ω5 10% 7W
3501	3198 013 04710	470Ω 2% 1/2W
3504	4822 116 83883	470Ω 5% 0.5W
3507	4822 050 21604	160k 1% 0.6W
3508	3198 012 16820	6.8k 1W
3509	2322 595 90021	VDR DC 1M A/495V
3510	4822 117 11951	2k 1% 0.1W
3511	4822 116 52276	3k9 5% 0.5W
3512	4822 116 52297	68k 5% 0.5W
3513	4822 116 52272	330k 5% 0.5W
3514	4822 053 10108	1Ω 5% 1W
3515	4822 053 10108	1Ω 5% 1W
3516	4822 116 10075	9Ω 220V
3518	4822 050 11204	120k 1% 0.4W
3519	4822 051 20223	22k 5% 0.1W
3520	4822 053 11333	33k 5% 2W
3521	4822 117 10118	1M 5% 0.5W
3522	4822 116 83961	6k8 5%
3523	4822 051 20105	1M 5% 0.1W
3524	4822 051 10102	1k 2% 0.25W
3525	4822 051 20479	47Ω 5% 0.1W
3526	4822 116 83303	1Ω 2W
3527	4822 117 11454	820Ω 1% 0.1W
3528	4822 117 10833	10k 1% 0.1W
3529	4822 051 20472	4k7 5% 0.1W

3530	4822 116 52297	68k 5% 0.5W
3531	4822 117 10833	10k 1% 0.1W
3533	4822 051 20159	15Ω 5% 0.1W
3535	4822 051 20273	27k 5% 0.1W
3536	4822 117 10837	100k 1% 0.1W
3537	4822 117 10833	10k 1% 0.1W
3538	4822 051 20332	3k3 5% 0.1W
3539	4822 117 10833	10k 1% 0.1W
3540	4822 117 10834	47k 1% 0.1W
3541	4822 117 10833	10k 1% 0.1W
3542	3198 012 11570	0Ω15 5% 1W
3543	4822 051 20478	4Ω7 5% 0.1W
3544	4822 051 20479	47Ω 5% 0.1W
3600	4822 050 22205	2M2 1% 0.6W
3601	4822 050 22205	2M2 1% 0.6W
3602	4822 051 20332	3k3 5% 0.1W
3603	4822 101 11319	100Ω LIN
3605	4822 051 20273	27k 5% 0.1W
3606	4822 051 10102	1k 2% 0.25W
3607	4822 051 20223	22k 5% 0.1W
3608	4822 051 20223	22k 5% 0.1W
3609	4822 101 11193	47k 30% LIN 0.1W
3610	4822 051 20683	68k 5% 0.1W
3611	4822 051 20822	8k2 5% 0.1W
3612	4822 051 20274	270k 5% 0.1W
3613	4822 051 20274	270k 5% 0.1W
3614	4822 050 21005	1M 1% 0.6W
3615	4822 050 18204	820k 1% 0.4W
3615	4822 116 52292	560k 5% 0.5W
3616	4822 116 52285	470k 5% 0.5W
3617	4822 050 11002	1k 1% 0.4W
3618	4822 051 10102	1k 2% 0.25W
3619	4822 051 20562	5k6 5% 0.1W
3620	4822 116 80176	1Ω 5% 0.5W
3620	4822 116 80676	1Ω5 5% 0.5W
3621	4822 116 80176	1Ω 5% 0.5W
3622	4822 116 80176	1Ω 5% 0.5W
3623	4822 117 10834	47k 1% 0.1W
3624	4822 052 10158	1Ω5 5% 0.33W
3625	4822 116 83872	220Ω 5% 0.5W
3626	4822 116 83872	220Ω 5% 0.5W
3627	4822 050 21003	10k 1% 0.6W
3630	4822 051 10102	1k 2% 0.25W
3631	4822 051 20332	3k3 5% 0.1W
3632	4822 117 10833	10k 1% 0.1W
3633	4822 050 21003	10k 1% 0.6W
3644	4822 117 10833	10k 1% 0.1W
3645	4822 116 52245	150k 5% 0.5W
3652	4822 051 20101	100Ω 5% 0.1W
3701	4822 117 10833	10k 1% 0.1W
3702	4822 117 10833	10k 1% 0.1W
3730	4822 117 10833	10k 1% 0.1W
3731	4822 117 10833	10k 1% 0.1W
3732	4822 051 20822	8k2 5% 0.1W
3733	4822 051 20822	8k2 5% 0.1W
3734	4822 117 10834	47k 1% 0.1W
3735	4822 117 10834	47k 1% 0.1W
3736	4822 051 10102	1k 2% 0.25W
3737	4822 051 10102	1k 2% 0.25W
3738	4822 117 11148	56k 1% 0.1W
3739	4822 117 11148	56k 1% 0.1W
3740	4822 051 20683	68k 5% 0.1W
3741	4822 051 20683	68k 5% 0.1W
3742	4822 116 52199	68Ω 5% 0.5W
3743	4822 116 52199	68Ω 5% 0.5W
3756	4822 117 10833	10k 1% 0.1W
3762	4822 051 20828	8Ω2 5% 0.1W
3765	4822 117 11507	6k8 1% 0.1W
3770	4822 117 10834	47k 1% 0.1W
3771	4822 116 83933	15k 1% 0.1W
3773	4822 116 83933	15k 1% 0.1W
3789	4822 051 20828	8Ω2 5% 0.1W
3790	4822 051 10102	1k 2% 0.25W
3792	4822 051 10102	1k 2% 0.25W
3900	4822 116 83868	150Ω 5% 0.5W
3901	4822 117 10353	150Ω 1% 0.1W
3902	4822 117 10353	150Ω 1% 0.1W
3903	4822 117 10353	150Ω 1% 0.1W
3905	4822 116 83883	470Ω 5% 0.5W
3906	4822 116 52201	75Ω 5% 0.5W
3907	4822 051 20561	560Ω 5% 0.1W
3908	4822 116 52201	75Ω 5% 0.5W
3909	4822 116 52201	75Ω 5% 0.5W
3910	4822 116 52201	75Ω 5% 0.5W
3911	4822 116 52201	75Ω 5% 0.5W
3913	4822 116 52201	75Ω 5% 0.5W
3915	4822 116 52201	75Ω 5% 0.5W
3916	4822 051 20822	8k2 5% 0.1W
3918	4822 051 20392	3k9 5% 0.1W
3919	4822 051 10102	1k 2% 0.25W
3920	4822 051 10102	1k 2% 0.25W
3921	4822 117 10353	150Ω 1% 0.1W
3922	4822 117 10353	150Ω 1% 0.1W
3923	4822 117 10353	150Ω 1% 0.1W
3924	4822 117 10353	150Ω 1% 0.1W
3925	4822 052 10688	6Ω8 5% 0.33W
3928	4822 051 20101	100Ω 5% 0.1W
3929	4822 117 10833	10k 1% 0.1W
3930	4822 051 20561	560Ω 5% 0.1W
3932	4822 116 52201	75Ω 5% 0.5W
3935	4822 116 52201	75Ω 5% 0.5W
3936	4822 117 10353	150Ω 1% 0.1W
3937	4822 117 10353	150Ω 1% 0.1W
3940	4822 117 10353	150Ω 1% 0.1W
3941	4822 117 10353	150Ω 1% 0.1W
3942	4822 051 20822	8k2 5% 0.1W
3944	4822 051 10102	1k 2% 0.25W
3945	4822 051 20392	3k9 5% 0.1W
3946	4822 051 10102	1k 2% 0.25W
3970	4822 051 20471	470Ω 5% 0.1W
3971	4822 117 10833	10k 1% 0.1W
3972	4822 117 10833	10k 1% 0.1W
3991	4822 116 52175	100Ω 5% 0.5W
3992	4822 051 20101	100Ω 5% 0.1W
3993	4822 051 20101	100Ω 5% 0.1W
3994	4822 116 52175	100Ω 5% 0.5W
3995	4822 116 52175	100Ω 5% 0.5W
3996	4822 116 52175	100Ω 5% 0.5W
3997	4822 116 52175	100Ω 5% 0.5W
3998	4822 116 52175	100Ω 5% 0.5W
4xxx	4822 051 10008	0Ω 5% 0.25W
4xxx	4822 051 20008	0Ω 5% 0.25W
9220	4822 051 20008	JUMPER
9225	4822 051 20008	JUMPER
9723	4822 051 20008	JUMPER
9724	4822 051 20008	JUMPER

5101	4822 146 11065	STANDBY TFM
5102	4822 157 70436	8.2µH
5103	4822 526 10704	BEAD 50MHz
5104	4822 157 11411	BEAD 100MHz
5105	4822 526 10704	BEAD 100MHz
5200	4822 157 11775	6.8µH 5%
5400	4822 157 11869	33µH 10%
5410	4822 146 11065	TFM SIG FIX
5411	4822 157 71097	0.56µH
5421	4822 157 11204	COIL LINE CORR.(29")
5421	4822 157 11839	COIL LINE CORR. (28")
5421	4822 157 11841	COIL LINE CORR. (28"WS,32"WS)
5422	4822 157 71535	COIL BRIDGE
5424	4822 157 63255	COIL BRIDGE
5430	8204 000 73321	LOT (29")
5430	8228 001 33243	LOT (25",28")
5461	4822 157 11411	BEAD 100MHz
5463	4822 157 11411	BEAD 100MHz
5465	4822 157 11411	BEAD 100MHz
5466	4822 157 71467	39U 10%
5467	4822 157 11411	BEAD 100MHz
5504	2422 549 43286	MAINS 35mH 1A5
5505	4822 157 11411	BEAD 100MHz
5506	2422 531 98042	TFM W8085-002 Y
5510	4822 157 11411	BEAD 100MHz
5620	4822 157 11771	0.09µH 10%

6103	4822 130 42488	BYD33D
6105	4822 130 34281	BZX79-B15
6106	4822 130 34499	BZX79-B20
6108	4822 130 30621	1N4148
6109	4822 130 31083	BYW55
6111	4822 130 32715	SB340
6120	4822 130 30621	1N4148
6121	4822 130 30621	1N4148
6122	3198 010 53980	BZX79-B3V9
6200	9322 149 10685	BZM55-C33
6201	4822 130 83757	BAS216
6202	4822 130 83757	BAS216
6203	4822 130 10852	BZX284-C6V8
6204	4822 130 10852	BZX284-C6V8
6205	4822 130 83757	BAS216
6405	4822 130 11027	BZX284-C33
6406	4822 130 83757	BAS216
6407	4822 130 83757	BAS216
6408	4822 130 42488	BYD33D
6421	4822 130 10753	BY359X-1500
6422	4822 130 10218	BY229X-800
6442	9322 129 42685	BZM55-C15
6461	4822 130 82512	BYV29F-400
6462	4822 130 41487	BYV95C
6464	5322 130 31938	BYV27-200
6468	4822 130 42488	BYD33D
6480	4822 130 42488	BYD33D
6481	4822 130 31024	BZX79-B18
6482	4822 130 83757	BAS216
6499	4822 130 83757	BAS216
6501	4822 130 31083	BYW55
6502	4822 130 31083	BYW55
6503	4822 130 31083	BYW55
6504	4822 130 31083	BYW55
6505	4822 130 34281	BZX79-B15
6506	4822 130 30621	1N4148
6507	4822 130 80791	BYV28-200/20
6508	4822 130 11415	BYV28-400/20
6510	4822 130 34281	BZX79-B15
6511	4822 130 83757	BAS216
6512	4822 130 83757	BAS216
6514	5322 130 31932	BZT03-C200
6515	4822 130 32904	BZV85-C5V6
6516	4822 130 83757	BAS216
6517	4822 130 31983	BAT85
6518	4822 130 83757	BAS216
6520	4822 130 42488	BYD33D
6521	4822 130 83757	BAS216
6522	4822 130 83757	BAS216
6600	4822 130 31983	BAT85
6616	4822 130 83757	BAS216
6619	4822 130 42488	BYD33D
6620	5322 130 31938	BYV27-200
6621	4822 130 42488	BYD33D
6622	5322 130 33635	BZV85-C8V2
6623	4822 130 83757	BAS216

7100	4822 130 44568	BC557B
7101	4822 130 40959	BC547B
7102	4822 130 11417	STP3NB60FP
7104	4822 130 11418	TCDT1102G
7407	4822 130 60511	BC847B
7408	9332 592 40126	BC368
7409	4822 130 60511	BC847B
7421	4822 130 63666	BU2520DF
7480	4822 130 11417	STP3NB60FP
7481	4822 130 44568	BC557B
7482	4822 130 11418	TCDT1102G
7499	4822 130 60373	BC856B
7502	4822 130 61675	BF487
7504	9322 126 65687	STP5NB60FP
7505	4822 130 60373	BC856B
7506	4822 209 81397	TL431CLPST
7510	4822 130 60511	BC847B
7511	4822 130 60373	BC856B
7528	4822 130 40981	BC337-25
7529	4822 130 60511	BC847B
7600	4822 130 44461	BC546B
7602	4822 130 60511	BC847B
7603	4822 130 60373	BC856B
7605	4822 130 60511	BC847B
7606	4822 130 60511	BC847B
7610	4822 130 11418	TCDT1102G
7620	4822 209 90009	TDA8177
7641	4822 130 60511	BC847B
7652	4822 130 60511	BC847B
7720	4822 130 60511	BC847B
7721	4822 130 60511	BC847B
7722	4822 130 60373	BC856B
7723	4822 130 60373	BC856B
7724	4822 130 60511	BC847B
7725	4822 130 60511	BC847B
7730	4822 130 60511	BC847B
7750	4822 209 32269	TDA2616/N1
7900	4822 130 40959	BC547B
7901	4822 130 40959	BC547B
7905	9332 592 40126	BC368
7906	4822 209 12334	L4940V85
7907	4822 130 60511	BC847B

Small Signal Panel [B]

Various

1001	2422 543 89022	RES XTL 6M000
1301	2422 540 98456	RES 12MHz
1305	2422 543 01092	RES XTL 4M433619
1308	2422 543 01097	RES XTL 3M579545
1405	2422 549 44369	FIL SAW 38MHz
1407	2422 549 44324	FIL TPWCC04BS
1408	2422 549 44372	FIL SAW 38MHz
1409	2422 025 16542	2P MALE
1651	2422 543 89019	RES XTL 8M432
1701	2422 543 89018	RES XTL 12MHz

2001	4822 126 11671	33pF
2002	4822 126 11669	27pF
2003	4822 126 13879	220nF 20% 16V
2004	4822 126 13879	220nF 20% 16V
2005	4822 126 14305	100nF 10% 16V
2006	4822 126 14305	100nF 10% 16V
2007	4822 126 14305	100nF 10% 16V
2008	4822 126 14305	100nF 10% 16V
2009	4822 122 33777	47pF 5% 63V
2010	4822 122 33777	47pF 5% 63V
2011	4822 122 33777	47pF 5% 63V
2012	4822 122 33777	47pF 5% 63V
2013	4822 124 12095	100µF 20% 16V
2014	4822 126 14305	100nF 10% 16V
2015	4822 126 14305	100nF 10% 16V
2016	4822 124 12095	100µF 20% 16V
2017	4822 126 14305	100nF 10% 16V
2019	4822 126 14305	100nF 10% 16V
2020	4822 126 13883	220pF 5% 50V
2022	4822 126 14305	100nF 10% 16V
2023	4822 126 14305	100nF 10% 16V
2024	4822 126 14305	100nF 10% 16V
2025	4822 126 14305	100nF 10% 16V
2026	4822 126 14305	100nF 10% 16V
2027	4822 126 14305	100nF 10% 16V
2028	4822 126 14305	100nF 10% 16V
2029	4822 126 14305	100nF 10% 16V
2031	4822 126 14305	100nF 10% 16V
2032	4822 126 14305	100nF 10% 16V
2033	4822 126 14226	82pF 5% 50V
2034	4822 126 14226	82pF 5% 50V
2035	4822 126 14226	82pF 5% 50V
2036	4822 126 14226	82pF 5% 50V
2037	4822 126 14226	82pF 5% 50V
2038	4822 126 14305	100nF 10% 16V
2300	4822 124 12095	100µF 20% 16V
2303	5322 126 11583	10nF 10% 50V
2304	4822 122 33741	10pF 10% 50V
2306	4822 126 13881	470pF 5% 50V
2307	4822 126 14305	100nF 10% 16V
2308	4822 122 33741	10pF 10% 50V
2313	4822 121 70159	0.1µF 16V
2314	4822 124 12095	100µF 20% 16V
2315	4822 126 14305	100nF 10% 16V
2317	4822 126 14491	2.2µF 10V
2318	4822 126 14494	22nF 10% 25V
2319	5322 126 11583	10nF 10% 50V
2320	4822 122 33741	10pF 10% 50V
2321	4822 126 14305	100nF 10% 16V
2322	4822 126 14305	100nF 10% 16V
2323	4822 126 14305	100nF 10% 16V
2324	5322 126 11583	10nF 10% 50V
2325	4822 126 14305	100nF 10% 16V
2328	4822 122 33761	22pF 5% 50V
2329	4822 126 14305	100nF 10% 16V
2330	4822 126 14305	100nF 10% 16V
2331	4822 126 14305	100nF 10% 16V
2332	4822 126 14305	100nF 10% 16V
2333	4822 126 14491	2.2µF 10V
2334	4822 126 14491	2.2µF 10V
2335	4822 124 80349	47µF 20% 6.3V
2336	4822 126 14491	2.2µF 10V
2338	5322 126 11583	10nF 10% 50V
2340	4822 124 23002	10µF 16V
2341	4822 124 12095	100µF 20% 16V
2350	4822 126 14305	100nF 10% 16V
2351	4822 126 14305	100nF 10% 16V
2352	4822 126 14305	100nF 10% 16V
2356	4822 126 14305	100nF 10% 16V
2357	4822 126 14305	100nF 10% 16V
2358	5322 126 11579	3.3nF 10% 63V
2359	4822 122 33752	15pF 5% 50V
2361	3198 016 31580	1P5 50V
2362	4822 126 11663	12pF
2365	4822 126 14305	100nF 10% 16V
2366	4822 126 14305	100nF 10% 16V
2367	4822 126 14305	100nF 10% 16V
2368	4822 126 14305	100nF 10% 16V
2369	4822 126 14305	100nF 10% 16V
2370	4822 126 14305	100nF 10% 16V
2371	4822 126 13193	4.7nF 10% 63V
2372	4822 126 14043	1µF 20% 16V
2373	4822 126 14305	100nF 10% 16V
2374	4822 126 14491	2.2µF 10V
2375	4822 126 14494	22nF 10% 25V
2376	4822 126 14305	100nF 10% 16V
2377	4822 124 12095	100µF 20% 16V
2378	4822 126 14305	100nF 10% 16V
2384	4822 126 14305	100nF 10% 16V
2406	4822 126 13883	220pF 5% 50V
2407	4822 126 13956	68pF 5% 63V
2408	3198 016 32780	2P7 50V
2409	4822 126 14491	2.2µF 10V
2410	4822 126 14472	1µF 10% 10V
2411	4822 126 14305	100nF 10% 16V
2412	4822 126 13193	4.7nF 10% 63V
2413	4822 124 80151	47µF 16V
2417	3198 017 44740	470nF 10V
2418	4822 126 13956	68pF 5% 63V
2420	4822 122 33753	150pF 5% 50V
2501	4822 122 33777	47pF 5% 63V
2502	4822 122 32927	220nF 20% 50V
2503	4822 122 32927	220nF 20% 50V
2504	4822 122 32927	220nF 20% 50V
2505	4822 122 32927	220nF 20% 50V
2508	4822 124 12095	100µF 20% 16V
2546	4822 124 23002	10µF 16V
2547	4822 124 23002	10µF 16V
2548	4822 124 23002	10µF 16V
2549	4822 124 23002	10µF 16V
2550	4822 126 14241	330P 50V
2551	5322 126 11579	3.3nF 10% 63V
2609	3198 016 31020	0603 25V 1nF
2610	4822 126 14238	2N2 50V
2611	5322 126 11578	1nF 10% 50V
2629	4822 122 32927	220nF 20% 50V
2636	4822 122 32927	220nF 20% 50V
2637	4822 122 32927	220nF 20% 50V
2638	4822 122 32927	220nF 20% 50V
2640	4822 126 13879	220nF 20% 16V
2641	4822 122 32927	220nF 20% 50V
2642	4822 122 32927	220nF 20% 50V
2651	4822 126 14305	100nF 10% 16V
2652	4822 122 33777	47pF 5% 63V
2653	4822 122 32927	220nF 20% 50V
2654	4822 126 13881	470pF 5% 50V
2655	4822 126 13881	470pF 5% 50V
2656	4822 126 13881	470pF 5% 50V
2657	4822 126 13881	470pF 5% 50V
2658	4822 126 13881	470pF 5% 50V
2661	4822 122 32927	220nF 20% 50V
2662	4822 122 32927	220nF 20% 50V
2663	4822 126 13881	470pF 5% 50V
2664	4822 126 13881	470pF 5% 50V
2665	4822 124 12095	100µF 20% 16V
2666	4822 124 12095	100µF 20% 16V
2667	3198 016 33380	3P3 50V
2668	3198 016 33380	3P3 50V
2669	4822 124 23002	10µF 16V
2670	5322 126 11583	10nF 10% 50V
2673	3198 016 31020	1nF 25V
2674	3198 016 31020	1nF 25V
2675	4822 124 23002	10µF 16V
2677	3198 030 82280	2U2 20% 50V
2677	4822 124 23002	10µF 16V
2678	4822 124 23002	10µF 16V
2679	4822 126 14305	100nF 10% 16V
2680	4822 124 23002	10µF 16V
2681	4822 126 14305	100nF 10% 16V
2682	4822 124 23002	10µF 16V
2685	3198 016 31020	1nF 25V
2686	3198 016 31020	1nF 25V
2690	4822 126 14305	100nF 10% 16V
2691	4822 126 14305	100nF 10% 16V
2692	4822 126 14305	100nF 10% 16V
2693	4822 126 13883	220pF 5% 50V
2702	4822 124 23002	10µF 16V
2703	4822 126 14305	100nF 10% 16V
2704	4822 124 23002	10µF 16V
2706	4822 124 12095	100µF 20% 16V
2707	4822 126 14305	100nF 10% 16V
2708	4822 124 23002	10µF 16V
2709	4822 126 14305	100nF 10% 16V
2710	4822 124 23002	10µF 16V
2712	4822 124 23002	10µF 16V
2713	4822 126 14305	100nF 10% 16V
2717	4822 126 14218	3.9pF 50V
2718	4822 126 11669	27pF
2719	4822 126 11663	12pF
2720	4822 126 14218	3.9pF 50V
2721	4822 126 11669	27pF
2723	4822 126 11663	12pF
2724	4822 126 14218	3.9pF 50V
2725	4822 126 11669	27pF
2726	4822 126 11663	12pF
2728	4822 126 14305	100nF 10% 16V
2729	4822 126 14225	56pF 5% 50V
2730	4822 126 14494	22nF 10% 25V
2731	4822 122 31765	100pF 2% 63V
2733	4822 126 14494	22nF 10% 25V
2738	4822 126 14494	22nF 10% 25V
2743	4822 126 14494	22nF 10% 25V
2747	4822 126 14507	18pF 5% 50V
2748	4822 126 14507	18pF 5% 50V
2755	4822 126 14305	100nF 10% 16V
2756	4822 126 14305	100nF 10% 16V
2757	4822 124 23002	10µF 16V
2758	4822 126 14305	100nF 10% 16V
2759	4822 126 14305	100nF 10% 16V
2760	4822 126 14305	100nF 10% 16V
2761	4822 126 14305	100nF 10% 16V
2762	4822 126 14305	100nF 10% 16V
2763	4822 126 14305	100nF 10% 16V
2764	4822 126 14305	100nF 10% 16V
2765	4822 126 14305	100nF 10% 16V
2766	4822 126 14305	100nF 10% 16V
2767	4822 126 14305	100nF 10% 16V
2770	4822 126 14305	100nF 10% 16V
2771	4822 126 14305	100nF 10% 16V
2772	4822 126 14305	100nF 10% 16V
2773	4822 126 14305	100nF 10% 16V
2774	4822 126 14305	100nF 10% 16V
2776	4822 126 14305	100nF 10% 16V
2785	4822 126 14305	100nF 10% 16V
2786	4822 126 14305	100nF 10% 16V
2788	4822 126 14305	100nF 10% 16V
2790	4822 126 14305	100nF 10% 16V
2792	4822 126 14305	100nF 10% 16V
2795	4822 126 14305	100nF 10% 16V
2796	4822 126 14305	100nF 10% 16V
2797	4822 126 13956	68pF 5% 63V
2798	3198 016 36810	680P 25V
2902	5322 126 11583	10nF 10% 50V

3001	4822 051 30472	4k7 5% 0.062W
3002	4822 051 30472	4k7 5% 0.062W
3003	4822 051 30223	22k 5% 0.062W
3006	4822 051 30471	470Ω 5% 0.062W
3007	4822 117 13521	470Ω 5% 0.63W
3008	4822 117 13526	150Ω 5% 0.63W
3009	4822 051 30689	68Ω 5% 0.063W
3011	4822 051 30471	470Ω 5% 0.062W
3012	4822 051 30471	470Ω 5% 0.062W
3013	4822 051 30103	10k 5% 0.062W
3014	4822 051 30682	6k8 5% 0.062W
3015	4822 051 30474	470k 5% 0.062W
3016	4822 051 30152	1k5 5% 0.062W
3017	4822 051 30472	4k7 5% 0.062W
3018	4822 051 30103	10k 5% 0.062W
3019	4822 051 30472	4k7 5% 0.062W
3020	4822 051 30103	10k 5% 0.062W
3021	4822 051 30103	10k 5% 0.062W
3023	4822 051 30471	470Ω 5% 0.062W
3024	4822 051 30273	27k 5% 0.062W
3025	4822 051 30221	220Ω 5% 0.062W
3026	4822 051 30103	10k 5% 0.062W
3027	4822 117 12925	47k 1% 0.063W
3028	4822 051 30471	470Ω 5% 0.062W
3029	4822 051 30103	10k 5% 0.062W
3030	4822 051 30103	10k 5% 0.062W
3031	4822 051 30103	10k 5% 0.062W
3032	4822 051 30471	470Ω 5% 0.062W
3033	4822 051 30103	10k 5% 0.062W
3034	4822 051 30101	100Ω 5% 0.062W
3035	4822 117 13522	100Ω 5% 0.63W
3039	4822 051 30101	100Ω 5% 0.062W
3040	4822 051 30103	10k 5% 0.062W
3041	4822 051 30562	5k6 5% 0.063W
3044	2120 108 92846	4k7 5%
3058	4822 051 30682	6k8 5% 0.062W
3059	2322 704 66201	620Ω 1%
3060	4822 051 30103	10k 5% 0.062W
3061	4822 051 30103	10k 5% 0.062W
3062	4822 051 30103	10k 5% 0.062W
3064	4822 117 13522	100Ω 5% 0.63W
3073	4822 051 30471	470Ω 5% 0.062W
3074	4822 051 30471	470Ω 5% 0.062W
3075	4822 051 30103	10k 5% 0.062W
3076	4822 051 30471	470Ω 5% 0.062W
3077	4822 051 30272	2k7 5% 0.062W
3078	4822 051 30471	470Ω 5% 0.062W
3079	4822 051 30471	470Ω 5% 0.062W
3080	4822 051 30103	10k 5% 0.062W
3081	4822 051 30471	470Ω 5% 0.062W
3083	4822 051 30471	470Ω 5% 0.062W
3084	4822 051 30103	10k 5% 0.062W
3085	4822 051 30471	470Ω 5% 0.062W
3086	4822 051 30471	470Ω 5% 0.062W
3087	4822 051 30471	470Ω 5% 0.062W
3088	4822 051 30471	470Ω 5% 0.062W
3090	4822 051 30471	470Ω 5% 0.062W
3091	4822 051 30471	470Ω 5% 0.062W
3092	4822 051 30221	220Ω 5% 0.062W
3300	2322 750 63908	3Ω9 5%
3304	2322 750 63908	3Ω9 5%

3306	4822 051 30221	220Ω 5% 0.062W
3307	4822 051 30183	18k 5% 0.062W
3308	4822 051 30684	680k 5% 0.062W
3310	4822 117 12925	47k 1% 0.063W
3311	4822 117 13632	100k 1% 0.62W
3314	4822 051 30103	10k 5% 0.062W
3315	4822 051 30102	1k 5% 0.062W
3316	4822 051 30123	12k 5% 0.062W
3317	4822 051 30221	220Ω 5% 0.062W
3318	4822 051 30102	1k 5% 0.062W
3320	4822 051 30101	100Ω 5% 0.062W
3321	4822 051 30101	100Ω 5% 0.062W
3322	4822 051 10102	1k 2% 0.25W
3324	4822 051 30222	2k2 5% 0.062W
3327	4822 117 13632	100k 1% 0.62W
3328	4822 051 30393	39k 5% 0.062W
3329	4822 117 13568	6Ω8 5%
3330	4822 051 30332	3k3 5% 0.062W
3331	4822 051 30102	1k 5% 0.062W
3333	4822 051 30102	1k 5% 0.062W
3334	4822 051 30102	1k 5% 0.062W
3335	4822 051 30332	3k3 5% 0.062W
3336	4822 051 30102	1k 5% 0.062W
3337	4822 117 12903	1k8 1% 0.063W
3338	4822 051 30682	6k8 5% 0.062W
3340	4822 051 30101	100Ω 5% 0.062W
3341	4822 051 30101	100Ω 5% 0.062W
3342	4822 051 30101	100Ω 5% 0.062W
3343	4822 051 30683	68k 5% 0.062W
3344	4822 051 30222	2k2 5% 0.062W
3345	4822 051 30103	10k 5% 0.062W
3346	4822 051 30333	33k 5% 0.062W
3347	4822 051 30223	22k 5% 0.062W
3348	4822 051 30222	2k2 5% 0.062W
3362	4822 051 30103	10k 5% 0.062W
3363	4822 051 30102	1k 5% 0.062W
3364	4822 051 30683	68k 5% 0.062W
3365	4822 051 30472	4k7 5% 0.062W
3366	4822 051 30102	1k 5% 0.062W
3367	4822 051 30102	1k 5% 0.062W
3370	4822 051 30101	100Ω 5% 0.062W
3371	4822 051 30479	47Ω 5% 0.062W
3372	4822 051 30471	470Ω 5% 0.062W
3376	4822 051 30101	100Ω 5% 0.062W
3377	4822 051 30101	100Ω 5% 0.062W
3378	4822 051 30153	15k 5% 0.062W
3382	4822 051 30471	470Ω 5% 0.062W
3384	4822 051 30101	100Ω 5% 0.062W
3385	4822 051 30471	470Ω 5% 0.062W
3386	4822 051 30223	22k 5% 0.062W
3388	4822 051 30102	1k 5% 0.062W
3389	4822 117 12925	47k 1% 0.063W
3390	4822 051 30153	15k 5% 0.062W
3391	4822 051 30683	68k 5% 0.062W
3393	4822 117 13632	100k 1% 0.62W
3394	4822 051 30472	4k7 5% 0.062W
3400	4822 117 11152	4Ω7 5%
3406	4822 051 30479	47Ω 5% 0.062W
3411	4822 051 30472	4k7 5% 0.062W
3414	4822 051 30472	4k7 5% 0.062W
3415	4822 117 12902	8k2 1% 0.063W
3416	4822 117 13568	6Ω8 5%
3418	4822 051 30391	390Ω 5% 0.062W
3419	4822 051 30759	75Ω 5% 0.062W
3435	4822 051 30472	4k7 5% 0.062W
3436	4822 051 30221	220Ω 5% 0.062W
3437	4822 051 30102	1k 5% 0.062W
3439	4822 051 30471	470Ω 5% 0.062W
3441	4822 051 30393	39k 5% 0.062W
3445	4822 051 30471	470Ω 5% 0.062W
3446	4822 051 30101	100Ω 5% 0.062W
3532	4822 051 30102	1k 5% 0.062W
3533	4822 051 30103	10k 5% 0.062W
3540	4822 051 30103	10k 5% 0.062W
3550	4822 051 30102	1k 5% 0.062W
3551	4822 051 30102	1k 5% 0.062W
3552	4822 051 30472	4k7 5% 0.062W
3610	4822 117 12925	47k 1% 0.063W
3611	4822 117 12925	47k 1% 0.063W
3612	4822 117 12925	47k 1% 0.063W
3613	4822 117 12925	47k 1% 0.063W
3614	4822 117 12925	47k 1% 0.063W
3615	4822 117 12925	47k 1% 0.063W
3616	4822 051 30682	6k8 5% 0.062W
3617	4822 051 30682	6k8 5% 0.062W
3621	4822 051 30105	1M 5% 0.062W
3636	4822 051 30105	1M 5% 0.062W
3637	4822 051 30105	1M 5% 0.062W
3638	4822 051 30105	1M 5% 0.062W
3642	4822 051 30105	1M 5% 0.062W
3644	4822 051 30105	1M 5% 0.062W
3653	3198 021 90030	JUMPER
3654	3198 021 90030	JUMPER
3655	4822 051 30101	100Ω 5% 0.062W
3656	4822 051 30101	100Ω 5% 0.062W
3657	4822 051 30334	330k 5% 0.062W
3658	4822 051 30334	330k 5% 0.062W
3659	4822 051 30334	330k 5% 0.062W
3660	4822 051 30334	330k 5% 0.062W
3661	4822 117 11817	1k2 1% 1/16W
3662	4822 117 11817	1k2 1% 1/16W
3663	4822 117 11817	1k2 1% 1/16W
3665	4822 051 30272	2k7 5% 0.062W
3673	4822 051 30472	4k7 5% 0.062W
3676	4822 117 11817	1k2 1% 1/16W
3677	4822 051 30334	330k 5% 0.062W
3678	4822 117 11817	1k2 1% 1/16W
3679	4822 051 30334	330k 5% 0.062W
3680	4822 117 11817	1k2 1% 1/16W
3683	4822 051 30272	2k7 5% 0.062W
3684	3198 021 90030	JUMPER
3685	3198 021 90030	JUMPER
3688	3198 021 90030	JUMPER
3689	3198 021 90030	JUMPER
3702	4822 117 12139	22Ω 5% 0.062W
3703	4822 051 30101	100Ω 5% 0.062W
3705	4822 051 30101	100Ω 5% 0.062W
3706	4822 051 30109	10Ω 5% 0.062W
3707	4822 051 30392	3k9 5% 0.063W
3708	4822 051 30272	2k7 5% 0.062W
3709	3198 021 90030	JUMPER
3710	4822 051 30391	390Ω 5% 0.062W
3711	4822 051 30102	1k 5% 0.062W
3712	4822 051 30391	390Ω 5% 0.062W
3713	4822 051 30391	390Ω 5% 0.062W
3714	4822 117 12139	22Ω 5% 0.062W
3716	4822 051 30472	4k7 5% 0.062W
3717	4822 051 30472	4k7 5% 0.062W
3718	4822 051 30221	220Ω 5% 0.062W
3719	4822 117 13574	1Ω5 5% 1206
3720	4822 117 13574	1Ω5 5% 1206
3721	4822 117 13572	22Ω 5% 1206
3722	4822 117 13572	22Ω 5% 1206
3725	4822 051 30105	1M 5% 0.062W
3728	4822 051 30101	100Ω 5% 0.062W
3731	4822 051 30101	100Ω 5% 0.062W
3732	4822 051 10102	1k 2% 0.25W
3733	4822 051 30101	100Ω 5% 0.062W
3739	4822 051 30101	100Ω 5% 0.062W
3740	3198 021 90030	JUMPER
3741	4822 051 30102	1k 5% 0.062W
3744	4822 051 30102	1k 5% 0.062W
3745	4822 051 30102	1k 5% 0.062W
3746	4822 051 30472	4k7 5% 0.062W
3747	4822 051 30689	68Ω 5%
3748	4822 051 30689	68Ω 5%
3749	4822 051 30689	68Ω 5% 0.063W
3754	4822 051 30109	10Ω 5% 0.062W
3755	3198 021 90030	JUMPER
3757	3198 021 90030	JUMPER
3759	3198 021 90030	JUMPER
3790	4822 117 13522	100Ω 5% 0.63W
3791	4822 117 13522	100Ω 5% 0.63W
3792	4822 117 13522	100Ω 5% 0.63W
3793	4822 117 12662	10Ω 5%
3793	4822 117 13522	100Ω 5% 0.63W
3794	4822 117 12662	10Ω 5%
3794	4822 117 13522	100Ω 5% 0.63W
3795	4822 117 12662	10Ω 5%
3795	4822 117 13522	100Ω 5% 0.63W
3796	4822 051 30101	100Ω 5% 0.062W
3796	4822 051 30109	10Ω 5% 0.062W
3797	4822 051 30101	100Ω 5% 0.062W
3900	4822 051 30221	220Ω 5% 0.062W
3901	4822 051 30221	220Ω 5% 0.062W
3903	4822 051 30221	220Ω 5% 0.062W
3905	4822 051 30221	220Ω 5% 0.062W
3906	4822 051 30101	100Ω 5% 0.062W
3907	4822 051 30221	220Ω 5% 0.062W
3909	4822 051 30221	220Ω 5% 0.062W
3910	4822 051 30221	220Ω 5% 0.062W
3911	4822 051 30101	100Ω 5% 0.062W

5301	4822 157 11876	6.8µH 10%
5302	4822 157 11876	6.8µH 10%
5403	2422 549 44461	IND VAR 40mH
5404	2422 535 95427	100mH
5405	2422 535 95427	IND FXD 100mHz 120R
5406	3198 018 33980	3U9 10%
5407	3198 018 56880	6U8 10%
5408	2422 549 44459	IND VAR 78mH
5409	3198 018 51080	1U 10%
5410	3198 018 33370	0U33 10%
5651	2422 549 43769	100mH
5652	2422 549 43769	100mH
5653	2422 549 43769	100mH
5654	4822 157 11716	BLM21P300SPT
5701	4822 157 71206	BLM21A601SPT
5702	2422 535 95427	100mH
5703	4822 157 11716	BLM21P300SPT
5704	4822 157 11716	BLM21P300SPT
5705	2422 535 95427	100mH
5706	4822 157 11778	5U6 10%
5707	4822 157 11781	BLM11A601SPT1
5708	4822 157 11778	5U6 10%
5709	4822 157 11778	5U6 10%
5710	4822 157 11778	5U6 10%
5711	4822 157 11781	BLM11A601SPT1
5713	4822 157 11781	BLM11A601SPT1
5718	3198 018 33370	0U33 10%
5720	4822 157 11781	BLM11A601SPT1
5910	4822 157 11781	BLM11A601SPT1

6001	4822 130 11528	1PS76SB10
6003	4822 130 11528	1PS76SB10
6303	4822 130 11594	BZX284-C47
6304	4822 130 83757	BAS216
6306	9322 129 37685	BZM55-C5V6
6307	4822 130 11528	1PS76SB10
6309	4822 130 83757	BAS216
6310	9322 129 38685	BZM55-C6V8
6311	9322 149 08685	BZM55-C22
6319	4822 130 83757	BAS216
6334	4822 130 83757	BAS216
6403	4822 130 10414	BA792
6652	9322 129 40685	BZM55-C10
6653	4822 130 83757	BAS216

7001	9352 629 88557	SAA5801/011 V30
7002	5322 130 42756	BC857C
7003	3198 010 42310	BC847BW
7004	3198 010 42310	BC847BW
7005	9322 116 74668	LD1117D33
7006	3104 317 42211	SOFTW.ASSY 310431702211
7007	9322 136 53668	MSM51V18165D-60JS
7008	3198 010 42310	BC847BW
7009	3198 010 42310	BC847BW
7010	5322 130 42756	BC857C
7011	4822 209 17377	M24C32-WMN6/PROG
7301	9352 625 23518	TDA9330H/N2
7303	5322 130 42756	BC857C
7308	9340 310 30215	PDTC144ET
7309	9340 310 30215	PDTC144ET
7310	9340 310 30215	PDTC144ET
7311	3198 010 42310	BC847BW
7312	3198 010 42310	BC847BW
7320	3198 010 42310	BC847BW
7322	3198 010 42310	BC847BW
7323	9352 625 24518	TDA9321H/N2
7324	5322 130 63679	BC847CW
7403	4822 130 60511	BC847B
7407	4822 130 60373	BC856B
7411	4822 130 60511	BC847B
7651	9322 143 53671	MSP3415D-FH-B3
7651	9322 149 63671	MSP3451G-FH-A1
7652	9351 874 90118	74HC4052PW
7656	9340 425 20115	BC847BS
7658	9340 425 20115	BC847BS
7663	9340 425 20115	BC847BS
7674	3198 010 42310	BC847BW
7675	9351 874 90118	74HC4052PW
7680	3198 010 42310	BC847BW
7681	3198 010 42310	BC847BW
7701	5322 130 42756	BC857C
7702	3198 010 42310	BC847BW
7704	4822 209 73852	PMBT2369
7708	4822 209 90034	SAA4990H/V0
7709	9352 640 20557	SAA4978H/V203
7713	9322 116 74668	LD1117D33
7714	4822 209 17307	MSM54V12222A-30JS
7715	4822 209 17307	MSM54V12222A-30JS
7716	2422 486 80737	IC SOCKET 32P

Main Switch Panel [E]

Various

0151	4822 256 91766	LED HOLDER
0201	2422 025 16268	2P MALE
0202	2422 025 16374	2P MALE
0923	2412 020 00724	2P MALE

0947	4822 267 10734	5P MALE
1910	4822 130 91478	IR RECEIVER
1951	4822 276 14024	2P 4/128A

⊣⊢

2930	4822 124 41584	100µF 20% 10V

⊣▭⊢

3957	4822 053 21335	3M3 5% 0.5W
3966	4822 053 21335	3M3 5% 0.5W
3978	4822 051 20101	100Ω 5% 0.1W
3982	4822 117 13577	330Ω 1% 1.25W

⊣▶⊢

6901	4822 130 10859	TLDR5400

CRT Panel [F]

Various

0298	2422 500 80052	9P FEMALE
0340	3104 311 02321	CABLE 11P 400mm
0383	2422 025 16382	3P MALE

⊣⊢

2300	4822 124 40764	22µF 100 V
2301	4822 124 40196	220µF 20% 16V
2302	5322 122 32286	3.3pF 5% 50V
2303	5322 122 32268	470pF 10% 50V
2304	4822 121 41856	22nF 5% 250V
2305	4822 124 41751	47µF 20% 50V
2306	4822 126 14585	100nF 10% 50V
2307	5322 122 32654	22nF 10% 63V
2308	4822 126 13486	15pF 2% 63V
2309	5322 122 32654	22nF 10% 63V
2310	4822 126 13689	18pF 1% 63V
2312	5322 122 32658	22pF 5% 50V
2313	4822 124 11565	10µF 20% 250V
2316	4822 121 40518	100nF 10% 250V
2317	5322 121 44356	4.7nF 5% 2KV
2318	5322 122 32654	22nF 10% 63V
2320	4822 126 13838	100nF 20% 50V
2321	5322 122 32531	100pF 5% 50V
2322	5322 122 32531	100pF 5% 50V
2323	5322 122 32531	100pF 5% 50V
2325	4822 126 14585	100nF 10% 50V

⊣▭⊢

3300	4822 052 10109	10Ω 5% 0.33W
3301	4822 053 12103	10k 5% 3W
3302	4822 051 20182	1k8 5% 0.1W
3303	4822 117 10965	18k 1% 0.1W
3304	4822 117 11454	820Ω 1% 0.1W
3305	4822 117 13577	330Ω 1% 1.25W
3306	4822 051 20478	4Ω7 5% 0.1W
3307	4822 051 20109	10Ω 5% 0.1W
3308	4822 117 11148	56k 1% 0.1W
3309	4822 117 10353	150Ω 1% 0.1W
3310	4822 051 10102	1k 2% 0.25W
3311	4822 051 20101	100Ω 5% 0.1W
3312	4822 117 11449	2k2 1% 0.1W
3313	4822 116 83872	220Ω 5% 0.5W
3314	4822 116 83872	220Ω 5% 0.5W
3315	4822 117 11139	1k5 1% 0.1W
3316	4822 117 11148	56k 1% 0.1W
3317	4822 051 20122	1k2 5% 0.1W
3318	4822 051 20159	15Ω 5% 0.1W
3319	4822 117 11454	820Ω 1% 0.1W
3320	4822 051 10102	1k 2% 0.25W
3334	4822 050 11002	1k 1% 0.4W
3335	4822 051 10102	1k 2% 0.25W
3336	4822 051 10102	1k 2% 0.25W
3337	4822 051 10102	1k 2% 0.25W
3338	3198 013 01020	1k 2% 1/2W
3339	3198 013 01020	1k 2% 1/2W
3340	3198 013 01020	1k 2% 1/2W
3341	4822 052 10151	150Ω 5% 0.33W
3342	4822 051 20471	470Ω 5% 0.1W
3344	4822 116 52191	33Ω 5% 0.5W
3345	4822 116 52191	33Ω 5% 0.5W
3347	3198 013 01520	1k5 2% 1/2W
3348	4822 050 11204	120k 1% 0.4W
3349	3198 013 01020	1k 2% 1/2W
3350	4822 116 83883	470Ω 5% 0.5W
3351	4822 116 83883	470Ω 5% 0.5W
3352	4822 116 83883	470Ω 5% 0.5W
3354	4822 117 11449	2k2 1% 0.1W
3355	4822 051 20478	4Ω7 5% 0.1W
3356	4822 051 10102	1k 2% 0.25W
3357	4822 051 20478	4Ω7 5% 0.1W
4xxx	4822 051 10008	0Ω 5% 0.25W
4xxx	4822 051 20008	0Ω 5% 0.25W

⎓

5300	2422 531 98035	TFM S13974-01 Y

⊣▶⊢

6305	4822 130 30842	BAV21
6306	4822 130 30842	BAV21
6307	4822 130 30842	BAV21
6310	4822 130 83757	BAS216

7300	4822 130 44154	BF199
7301	4822 130 42589	BF370
7302	5322 130 41888	BD140-16
7303	5322 130 41886	BD139-16
7307	9352 561 40112	TDA6108
8317	3104 311 01901	CABLE 2P 560mm
8325	3104 311 01911	CABLE 3P 680mm

Side I/O Panel [O]

Various

0900	2422 026 04926	4P FEMALE
0901	4822 267 10975	3P
0902	4822 267 31014	HEADPHONE SOCKET
0936	2422 025 12485	11P MALE

⊣⊢

2905	4822 122 33177	10nF 20% 50V
2906	4822 122 33177	10nF 20% 50V

⊣▭⊢

3901	4822 051 20101	100Ω 5% 0.1W
3902	4822 116 52201	75Ω 5% 0.5W
3903	4822 051 20101	100Ω 5% 0.1W
3904	4822 116 52201	75Ω 5% 0.5W
3905	4822 050 11002	1k 1% 0.4W
3906	4822 050 11002	1k 1% 0.4W
3907	4822 117 10834	47k 1% 0.1W
3908	4822 050 11002	1k 1% 0.4W
3909	4822 117 10834	47k 1% 0.1W
3910	4822 116 52276	3k9 5% 0.5W
3911	4822 050 21003	10k 1% 0.6W
3912	4822 050 21003	10k 1% 0.6W

Top Control Panel [P]

Various

0345	4822 267 10748	3P MALE
1701	4822 276 13775	SWITCH
1702	4822 276 13775	SWITCH
1703	4822 276 13775	SWITCH
1704	4822 276 13775	SWITCH
1705	4822 276 13775	SWITCH

⊣▭⊢

3701	4822 051 20391	390Ω 5% 0.1W
3702	4822 117 13528	200Ω 1% 0.125W
3703	4822 117 10845	620Ω 1% 0.1W
3704	4822 117 11534	1k1 1% 0.1W
3705	4822 117 11951	2k 1% 0.1W
3999	4822 051 10102	1k 2% 0.25W